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HYPERMOBILITY OF THE FIRST METATARSAL BONE: THE INTERLINKING FACTOR BETWEEN METATARSALGIA AND LONGITUDINAL ARCH STRAINS*

BY DUDLEY J. MORTON, M.D., NEW HAVEN, CONN.

Assistant Professor, Department of Surgery, Yale University, School of Medicine, New Haven, Conn. and Research Associate, American Museum of Natural History, New York

The inner anterior pillar of the foot, comprising the first metatarsal, the inner cuneiform, and the scaphoid bones, is generally regarded as a very stable member. In fact, although text-books may dwell upon the relative freedom of motion permitted in the socket-like articulation of the astragalus with the scaphoid bone, after that joint has been discussed, reference to the mobility of the joints lying anteriorly, is limited to a rather casual statement as to their firm, resilient approximation when the foot assumes the burden of body-weight. Study of a large number of feet demonstrates, however, that the inner pillar of the foot does not warrant such confidence, and that in a very considerable percentage of individuals it presents a condition of instability, which is conducive to painful disorder, both in the metatarsal region and in the longitudinal arch.

This instability of the inner pillar is traced to the articulation of the inner cuneiform bone with the scaphoid, and also to an undue amount of play between the inner and middle cuneiform bones. Naturally the motion is manifested most conspicuously in the most distant unit of this segment of the foot, and for this reason the term "hypermobility of the first metatarsal" has been selected to designate the condition. The associated symptoms in the metatarsal region duplicate to a considerable extent those of a short first metatarsal bone (metatarsus atavicus)[1], but in some of the cases

*This is a companion article to the one entitled "Metatarsus Atavicus" (congenital short first metatarsal bones), which appeared in the July 1927, issue of this *Journal* (IX, 531). These articles are based upon an extended study of metatarsalgic disorders, and will be followed by a third paper reporting the analysis of a hundred consecutive cases of "Anterior foot trouble".

observed, the symptoms were confined to the longitudinal arch, resembling those of foot strain. The range of symptoms and the relationship of this hypermobility with metatarsal, and with arch disorders, are readily understood when its effect upon the foot's mechanism is studied.

Hypermobility of the first metatarsal bone would hardly constitute a factor in foot trouble if the increased arc of motion were located entirely in the plantar direction; the fault lies in the increase of dorsal movement, or hyperextension, of the first metatarsal bone, whereby the normal stability of the inner border of the foot becomes reduced or lost.

When body-weight is imposed upon a foot, the slack of the plantar ligaments must be taken up before the load is actually supported. In a foot of the type under consideration, the plantar structures attached to the four outer metatarsal bones become taut, while the inner pillar of the foot is still a lax and yielding member. Thus the second metatarsal bone is compelled to bear the brunt of the load, or yielding to some degree, to share it with the third. In this manner, an unduly mobile first metatarsal bone is a relatively non-functioning member, except under a strong propulsive action of the long flexor hallucis. The actual effect upon the forepart of the foot does not differ greatly from what was noted in metatarsus atavicus; in both cases the head of the second metatarsal bone exerts the strongest contact with the ground and a corresponding physiological hypertrophy of its shaft appears as the inevitable result.

X-ray findings: As in metatarsus atavicus, the dorsoplantar view of the foot has the most important diagnostic value. The increased size of the shaft of the second metatarsal bone as compared with the size of the

FIG. 1. MALE.

FIG. 2. FEMALE.

HYPERMOBILITY OF THE FIRST METATARSAL BONE. Note the enlargement of the second metatarsal as compared with the size of the three outer ones, also the line of lessened density between the inner and middle cuneiform bones.

three outer ones, is the outstanding morphological characteristic. The accompanying x-ray pictures show such feet in both male and female subjects. In Figures 1 and 2 the hypertrophy of the second metatarsal bone is due to the hypermobility of the first; in Figures 3 and 4 is seen the hypertrophy associated with metatarsus atavicus, or short first metatarsal bones; Figures 5 and 6 show the results of hypermobility combined with a moderate shortness of the first metatarsal bone. There is nothing in the appearance of the second metatarsal bone to warrant regarding its enlargement as other than an orderly physiological hypertrophy, due to the increased functional demands imposed upon it by the presence of one or both of these factors.

In many of the x-ray pictures taken of the present type of cases, there is a very definite cleft between the inner and middle cuneiform bones,—much more than would be expected normally. Such a cleft or separation is highly suggestive of the abnormal amount of play permitted between these two bones. Variations in the plane of their adjacent surfaces, however, and its relationship to the line of the ray, will naturally influence the distinctness with which this feature appears on the film.

PATHOLOGY

Because of its three major points of contact—the heel and the heads of the first and fifth metatarsal bones—the foot is usually described as having a tripod arrangement. If one of the legs of a tripod should become unstable, the collapse is not toward one side, but toward both of the sides adjacent to the yielding leg. So in the foot, a yielding of its inner pillar

FIG. 3. MALE. FIG. 4. FEMALE.

METATARSUS ATAVICUS (short first metatarsal bone). Showing similar enlargement of the second metatarsal.

naturally affects both anterior and medial sides of the foot, since it is an equally important element to both. Hence, it would seem well to consider the effects upon these two portions of the foot separately.

Metatarsal disorder: The present studies of anterior foot trouble have emphasized, above all else, a very different concept of the "anterior metatarsal arch" than is ordinarily held. In fact, it would stamp the term as an anatomical misnomer. Admittedly, the ball of the foot assumes transversely a more or less concave form when in a passive state; but in a weight-bearing foot the heads of all the metatarsal bones lie in a single horizontal plane—each one of them having direct contact with the ground or supporting surface. In other words, there is no real arched conformation maintained in this part. Strength has apparently been given to the concept of an anterior arch by text-book pictures of cross sections, in which the sections have been cut obliquely through the heads of the first and fifth metatarsal bones, but *through the shafts of the three middle metatarsals* (Fig. 8).

The clinical word "metatarsalgia" is commonly used interchangeably with the term "depressed anterior arches". But since the heads of the metatarsal bones lie on the same horizontal plane in their functional relationship, and because of the usual solidity of the supporting surface, there can be no actual depression of the middle ones. The disorder consists of an abnormal distribution of weight as borne by each metatarsal bone and in the correspondingly altered strength of contact of each metatarsal head with the ground. For example, a person may press the tips of four fingers obliquely upon the surface of a table. With moderately firm contact,

FIG. 5. MALE. FIG. 6. FEMALE.

Laxity and a moderate degree of shortness of the first metatarsal bone in combination.

practically all of the compressibility of the soft digital pads is taken up. He may now vary the amount of pressure exerted upon each finger tip. This will not cause any measurable depression or change in their position, even though there is a very considerable difference in the pressure borne by them. The strength of their respective contacts is directly proportional with the tautness of the flexor tendons of each finger. This phenomenon of different pressures is essentially *physiological* and not morphological.

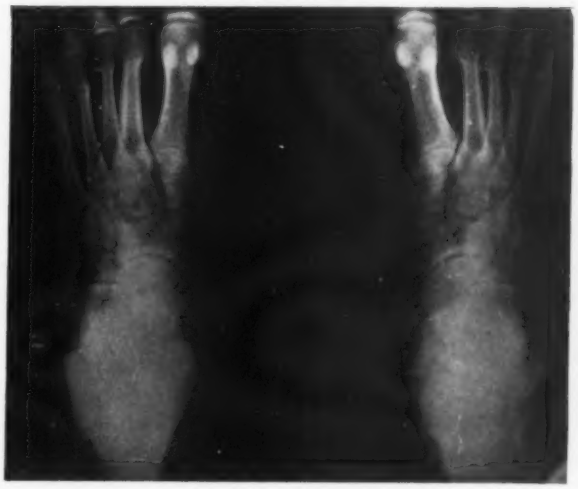

FIG. 7
Congenital hypermobility of the first metatarsal bone,—daughter of the patient whose feet are shown in Figure 2.

The simile applies to the metatarsal bones of the foot. Under body-weight, the head of each metatarsal bone presses directly upon the ground taking up the compressibility of the underlying soft tissues. The firmness of their contacts is determined by the tautness of their respective plantar ligaments. If the first metatarsal bone is lax, it does not have the same strong supporting contact which the others show; but there will be no gross change in the morphological relationship of the heads of these bones. Hence, the term "depressed anterior arches" is a very inapt *morphological* designation of a *physiological* phenomenon; but still more unfortunately, it promotes misapprehension and obscures the real nature of metatarsalgic disorders.

As formerly stated, instability of the first metatarsal affects the mechanism of the forepart of the foot in a manner not unlike the short first metatarsal bone,—*i.e.*, its laxity causes a corresponding increase in the burden placed upon the second metatarsal. But there is a difference in their effects upon the feet, for under forceful muscular exertion, this laxity is overcome by muscle pull and the first metatarsal bone enters strongly into action with a reduction in the strains of active function upon the second; whereas in metatarsus atavicus such forceful efforts have the opposite effect by concentrating the strains upon the longer second metatarsal bone. Hence, it is readily seen that stance is the more vicious phase of function where instability of the first metatarsal is the disturbing factor; while in metatarsus atavicus, any action which forcibly concentrates body-weight upon the ball of the foot is the more injurious.

Longitudinal arch: The intimate relationship between hypermobility of the first metatarsal bone and arch strain is due to the fact that the posture of the foot is naturally involved in the integrity of its inner anterior pillar. This medial member is the important buttress by which the foot is safeguarded from pronation, since it alone lies to the inner side of the foot's functional axis (Fig. 9). Hence, to whatever degree laxity prevails in this portion of the foot, to a corresponding degree lateral stability is impaired, and the foot is susceptible to faulty posture with its attendant strains. It might be noted here that this hypermobility has been observed to be a very common factor in the "weak feet" of children. In fact, even in very young adults symptoms of a mild arch strain seem to be quite as frequent from this cause, as pain or discomfort in the metatarsal region.

CLINICAL SYMPTOMS

Objective signs: Nearly all feet with an appreciable amount of hypermobility of the first metatarsal bone present some degree of pronation. But one of the most striking signs is the softness and fineness of the skin beneath the ball of the great toe, as compared with the thickened and callous epidermal growth under the heads of the middle metatarsal bones. This character seldom appears before adulthood, however.

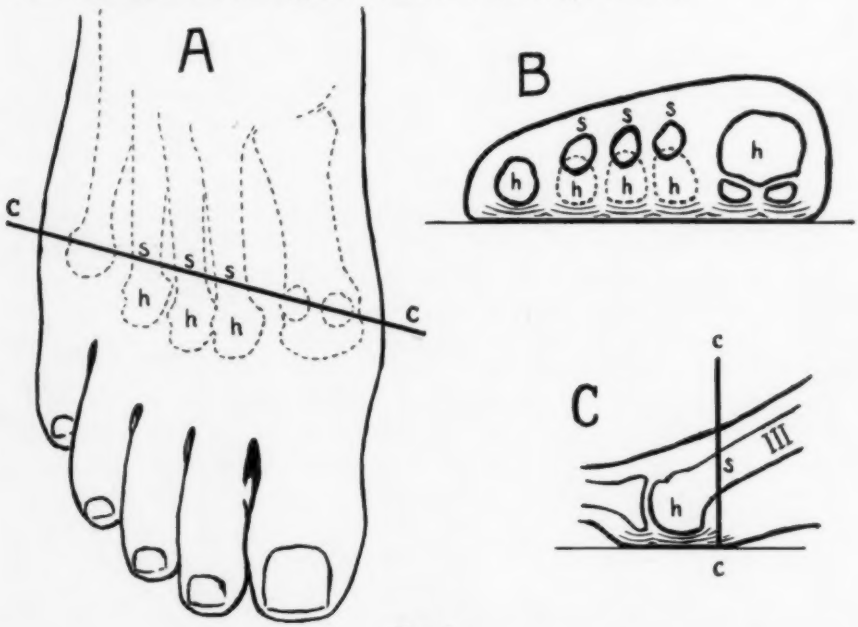

FIG. 8

Transverse section through the forepart of the foot. *A*. Sketch showing how a cross section (c-c) through the heads of the first and fifth metatarsal bones passes through the shafts (s s s) of the three middle metatarsals. *B*. A schematic drawing of the cross section showing the apparent arch formed by the shafts (s s s) of the middle metatarsals with the heads of the first and fifth. The projected position of the heads (h h h) of the middle ones is drawn with dotted outline. *C*. Side view of the section (c-c) through the shaft of the middle metatarsal bone, showing the abrupt dip of the head (h) immediately in front of the cut.

To test the amount of mobility of the metatarsal bones, the foot is supported in a relaxed condition, and grasped firmly by the examiner in the region of the scaphoid bone (the thumb being on the plantar side of the foot). Alternate pressure against the heads of the three inner metatarsal bones will elicit their relative range of dorsal movement. Where hypermobility is present, it will be noted that the movement of the first metatarsal is quite free and comes to a gradual stop, whereas the movement of the second and third is short and comes to a more or less abrupt stop.

The point of plantar tenderness at the juncture of the middle cuneiform and second metatarsal bones, which was described in the previous article on metatarsus atavicus, is sometimes found in these cases, but only occasionally.

Subjective symptoms: There is no need to enter into a lengthy discussion of subjective symptoms since they comprise to varying extent nearly all which orthopaedic surgeons ordinarily associate with metatarsalgia or chronic arch strain. The metatarsalgic symptoms are generally of a diffuse, indefinite type, but some patients complain of localized areas of tingling, numbness, or sharp pain, even simulating that of "Morton's toe". Except that the callosities may be the mechanical cause of acute pain, the symptoms are, on the whole, characteristic of chronic nerve irritation, or in the older cases of chronic traumatic neuritis.

FIG. 9

The anterior pillar as the medial stabilizer of the foot, occupies alone a position to the inner side of the functional axis (indicated by the line extending forward between the first and second digits). (*Journal of Bone and Joint Surgery.*)

DISCUSSION

The first thing to be recognized in considering the etiological aspect is, that the present condition is unlike many other human ailments where diagnosis is determined by the presence or absence of some specific cause (as for example, bacteria). It is difficult to set a limit as to what may be regarded as an allowable range of metatarsal mobility, or to state just where the range of abnormal motion begins. Other factors, also, such as excessive use and abuse of the feet, being contributory to the production of symptoms, must be taken into calculation.

Undoubtedly, rickets and debilitating illnesses of childhood are prominent causes of "weak feet" in children. But since a laxity of the anterior pillar of the foot is invariably present in these cases, it is impossible to determine to what extent the hypermobility in adults may be a sequella of these juvenile weak feet, and to what degree an inherited trait predisposes these feet to the early pronation of childhood.

The question might properly be asked: "Would

such mobility of the first metatarsal bone be a source of foot trouble under primitive, non-shoe-wearing circumstances?" Probably not! But certainly among present conditions of civilization there is plenty of reason to conclude that this hypermobility constitutes a major factor in the static varieties of foot disability.

Heredity: The similarity shown in the feet of mother and daughter (Figs. 2 and 7) and in other parent-child studies, testify quite strongly to the inheritability of this peculiar structural trait in the feet. It is the laxity of the first metatarsal that is here referred to, and not the hypertrophy of the second; for the increased development of the latter is regarded chiefly as a secondary phenomenon, and its most conspicuous examples are found usually in persons of middle age or over.

Age: Symptoms of discomfort are rarely encountered during the periods of youth. During infancy and childhood, the foot is quite flexible throughout. With its progressive rigidity during adolescence, there is still enough general pliability to ensure a fairly even distribution of pressure across the ball of the foot, even though laxity persist along the inner border.

Subjective symptoms make their first appearance when the feet have taken on the firmer rigidity of adult structures, and when the lax first metatarsal bone either (1) predisposes the foot to a faulty, pronated posture with acute strain, or (2) induces metatarsalgic trouble by concentrating the burden of body-weight upon the more rigidly held second metatarsal.

Sex: There is little reason to believe that this localized hypermobility is not distributed about equally in both sexes during earlier years. Except when associated with an appreciable degree of pronation during this otherwise symptomless period, it can hardly be regarded as an actual anomaly. Later, however, differences in habits, particularly as regards footwear, are definitely to the disadvantage of the female sex, with the result that women comprise the great majority of the adult clinical cases.

GENERAL CONSIDERATIONS

Under ordinary circumstances, the word "metatarsalgia" could hardly be regarded as deserving official recognition in diagnostic nomenclature. Literally translated as "metatarsal pain", only its Greek roots would seem to commend it for diagnostic use over the English word "headache" for painful conditions in the head. But while the word "gastralgia" (pain in the stomach) is similarly dignified with a Greek derivation, the scientifically inclined internist would be loath to admit so indefinite and vague a diagnostic term in his list of diseases. The word "metatarsalgia" has, however, been justified for general use because of the obscurity of the underlying factors, but to the orthopaedic surgeon who is interested in foot conditions, some more specific classification of anterior foot disorder seems desirable.

According to present studies, the other term "depressed anterior arches" does not deserve the same consideration,—in the first place because the heads of the metatarsal bones do not form an arch and, second, because there is no actual depression, since the necessary compact nature of

supporting surface naturally obstructs any downward movement of the heads of the middle metatarsal bones. Both of the predisposing factors referred to in this writing (1) the short first metatarsal, and (2) the laxity of the plantar tissues attached to the inner anterior pillar of the foot, are primarily structural conditions; but the disturbance is essentially a physiological one, comprising an abnormal or atypical distribution of body-weight upon the heads of the different metatarsal bones. The term "depressed anterior arches" is objected to principally because it promotes what appears very definitely to be a false concept of the mechanism of the anterior foot disorder.

Unquestionably either short, or unstable first metatarsal bones are to be found in many feet that have never sensed any related discomfort; nor may symptoms ever disclose their presence so long as such feet are not overworked or unduly abused. Nevertheless, these factors must be classed as potential causes of foot disability, and their relation to the symptoms should be recognized when such trouble begins.

Pain in the anterior portion of the foot is not generally considered as sufficient justification for routine x-ray examination. Possibly it is not! But if comprehensive, individual attention is to be given to patients complaining of this more or less tedious, chronic, and painful type of foot disability, it is difficult to see how this part of the examination can be omitted. Empirical methods of treatment without use of x-ray examination, may ordinarily ensure a good average of success in caring for these cases, but a definite knowledge of the characteristics of the foot skeleton will certainly add an appreciable margin of more efficient service toward the patient's benefit, and be a source of greater confidence and satisfaction to the physician.

TREATMENT

There are three distinct phases to be considered in prescribing treatment for cases of hypermobility of the first metatarsal bone; namely, (1) structural, (2) functional, and (3) chronic nerve irritation. It seems hardly necessary to discuss the latter phases at length, since they are familiar to all orthopaedic surgeons. These few paragraphs are intended rather to serve for emphasizing certain points of therapeutic interest.

The nerves form the chief vehicle for subjective symptoms; and it is by the remission of pain and discomfort that both patient and physician are inclined to judge the success and progress of treatment. Consequently since these symptoms are actually manifestations of painful nerve stimuli, it is obvious that attention should be focused upon the source of such nerve irritation. That source does not lie in the structural phase alone, but in the combined structural and functional phases.

Hence, necessary restriction of the patient's physical activities is as much a part of the treatment as caring for the structural factors. This is particularly true in the more chronic cases, where continued nerve irritation has produced a state of acute hyperaesthesia with the tissue changes of an actual chronic traumatic neuritis.

For the structural condition, the type of in-sole described in the article on metatarsus atavicus has proved useful, but preferably with the steel strip inserted in the shank of the shoe. Flexible shank shoes are contra-indicated. A wedge of proper thickness is applied in the inner side of the heel to compensate for associated pronation. Callosities should of course be removed.

Since the feet are not free from disorders of a more general character, the possible presence of other factors, such as arthritic or infectious conditions, neuritis due to wet feet or exposure, etc., should be borne in mind and receive their part in the scheme of treatment.

Conservative measures prove sufficient in caring for the great majority of these cases, but others presenting more advanced degrees of pronation deformity, call for surgical procedures. These cases are suitable subjects for either the flat-foot operation described by Miller[2] or for one based upon the present studies. In the latter method, arthrodesis is performed between the inner and middle cuneiform bones, and between these two bones and the scaphoid. Details of this operation will be presented in the near future.

SUMMARY

"Hypermobility of the first metatarsal bone" is due to unusually free motion in the joint between the inner cuneiform and scaphoid bones, and between the inner and middle cuneiforms.

The resulting instability of the inner anterior pillar affects the metatarsal portion, and also the longitudinal arch of the foot.

Physiological hypertrophy of the second metatarsal bone is the most notable structural feature. It is similar to the enlargement of this bone observed in feet with a short first metatarsal.

Metatarsalgic symptoms are more frequent than the symptoms of arch strain, although pain may coexist both in the forepart of the foot and in the arch.

Subjective symptoms rarely appear before adult life, although the laxity of the first metatarsal bone seems to be a condition acquired congenitally or during early childhood.

Analysis of a large group of metatarsalgic cases in which hypermobility or brevity of the first metatarsal was present (singly or in combination), indicates that the disorder is essentially a physiological one, comprising an improper distribution of stresses borne by the different metatarsal bones; it is not attended with any measurable change in the relative position of the metatarsal heads as inferred by the term "depressed anterior arches". This term is therefore regarded as inapt, and as conducive to misapprehension of the real nature of static disorders in this part of the foot.

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THE STYLOID EPIPHYSIS OF THE FIFTH METATARSAL BONE

BY LAMBERT ROGERS, F.R.C.S. EDIN., CARDIFF, WALES

Assistant in the Surgical Unit, The Welsh National School of Medicine, The Royal Infirmary, Cardiff. Past Prosector to the Royal College of Surgeons of England

Conflicting views are held as to the frequency of occurrence of an epiphysis for the styloid process of the fifth metatarsal bone. Thus while Grüber[1], J. E. Frazer[2], and others regard an epiphysis as of occasional occurrence, Thurston Holland[3] believes that it occurs frequently and Schouwey[4] that it is constant between the ages of thirteen and fourteen.

Some precise knowledge as to the frequency and appearance of an epiphyseal line through the styloid is desirable, since a fracture at the base of the metatarsal may be confused with it. Fifty subjects therefore, between the ages of ten and seventeen were investigated with the following results:

An epiphysis was present in fourteen, *i.e.*, twenty-eight per cent. of subjects. Of those examined thirty-eight were boys, twelve girls. Of the fourteen with an epiphysis present, ten were boys, four were girls.

The investigation was undertaken from x-ray plates, from which the drawings in the figure were made. These show the types of epiphysis.

The examination was carefully made, using only good plates and as far as possible two views of each foot, because in several instances it was noticed that the epiphysis appeared doubtful or absent in one view but was distinct in the other.

The table shows the age and sex of each subject. The plates were collected from the Royal Infirmary and the Prince of Wales' Hospital, Cardiff.

The styloid epiphysis may be analogous to the extra tip epiphysis which occurs at times on the olecranon and by separation gives rise to one form of loose body in the elbow joint[5]; but on the other hand it may represent a true traction epiphysis produced by the tendon of the peroneus brevis, or possibly the abductor of the fifth metatarsal (Wood's muscle), which is frequently present in man, and, arising from the outer tubercle of the os calcis and the plantar fascia, is inserted into the prominence at the base of the fifth metatarsal.[7]

The first of the metatarsal epiphyses to appear is that for the proximal end (base) of the first bone. This is seen about the third year, while the

distally placed (head) epiphysis for the other bones appears between the third and fifth years and rarely not until the eighth.[6]

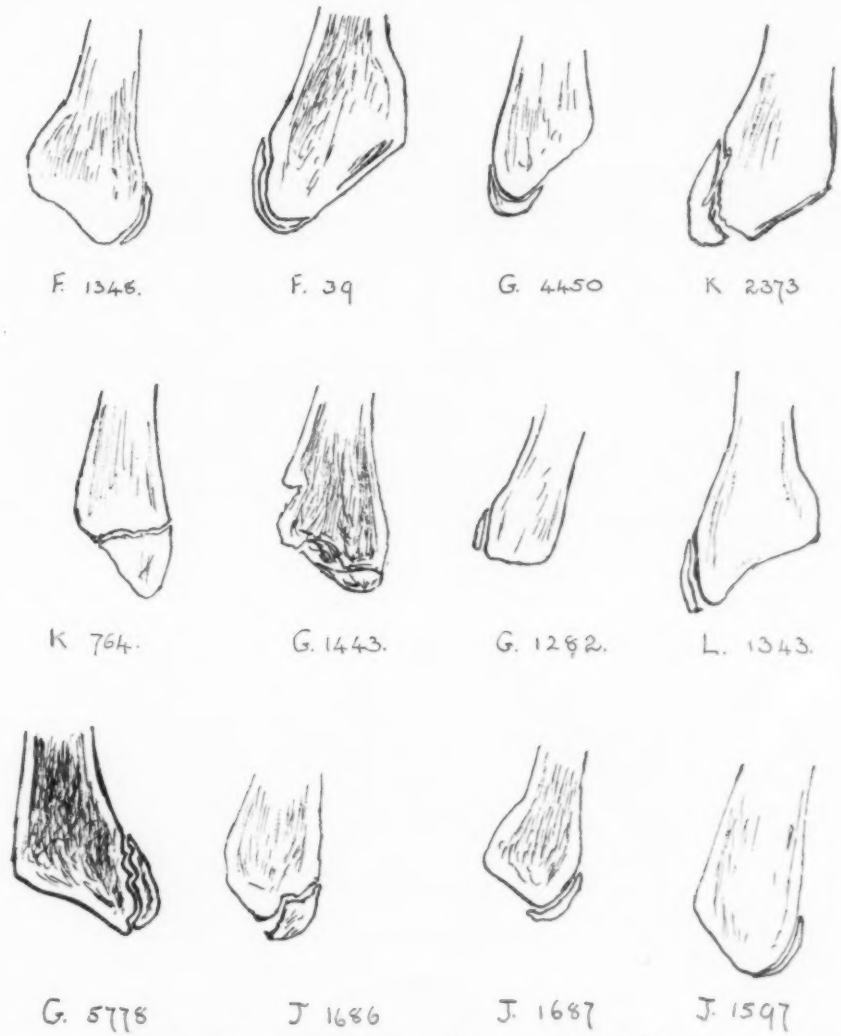
CONCLUSION

An epiphysis for the styloid process of the fifth metatarsal bone occurs between the ages of ten and seventeen, in twenty-eight per cent. of subjects. (Fifty cases examined.)

No	Initials	Reference	Age	Sex	Record
1.	M. H.	J. 1666	12.	F.	PRESENT
2.	G. R.	J. 1596	15.	M.	PRESENT
3.	F. H.	J. 1139	13.	M.	ABSENT
4.	G. J	J. 2024	17.	M.	"
5.	R. M.	E. 431	16.	M.	"
6.	M. S.	E. 3449	17.	F.	"
7.	W. P.	E. 2002	10.	M.	"
8.	T. W.	E. 919	17.	M.	"
9.	E. M.	E. 94	11.	F.	"
10.	R. E.	F. 1025	12.	M.	"
11.	R. S.	F. 1348	14.	M.	PRESENT
12.	T. M.	F. 1571	10.	M.	ABSENT
13.	F. S.	F. 2246	11.	M.	"
14.	D. S	F. 446	12.	M.	"
15.	C. H	F. 302	11.	F.	"
16.	C. T.	G. 6032	13.	M.	"
17.	G. B	F. 39	16.	M.	PRESENT
18.	J. H.	G. 3971	12.	M.	ABSENT
19.	N. H.	G. 4450	13.	F.	PRESENT
20.	E. P.	G. 4619	13.	F.	ABSENT
21.	G. M.	G. 4580	12.	M.	"
22.	E. M.	G. 5142	17.	F.	"
23.	J. B.	G. 3663	13.	M.	"
24.	W. R.	G. 5778	16.	M.	PRESENT
25.	J. L.	G. 2649	10.	M.	ABSENT
26.	F. W.	G. 2574	15.	M.	ABSENT
27.	J. B.	G. 1443	13.	M.	PRESENT
28.	W. S.	G. 1262	14.	M.	PRESENT
29.	J. S.	G. 1189	14.	M.	PRESENT
30.	A. S.	G. 1041	15.	M.	ABSENT
31.	R. K.	K. 765	15.	M.	PRESENT
32.	D. M	I. 1107	15.	M.	ABSENT
33.	G. H.	K. 852	17.	M.	"
34.	G. S.	L. 1343	16.	M	PRESENT
35.	S. I.	L. 621	10.	M.	ABSENT
36.	M. R.	I. 3462	11.	M.	"
37.	J. P.	I. 3469	13.	F.	"
38	W. P.	K. 2373	17.	M.	PRESENT
39	C. H.	K. 2354	17.	F.	ABSENT
40	C. P.	M. 33.P	14.	M.	"
41	M. W.	M. 34.P	12.	M.	"
42	H. F D	M. 35.P	10.	M.	"
43	I. T.	M. 36.P	12.	M.	"
44	A. M.C.	M. 82.P	10.	F.	PRESENT
45	D. D.	M. 135.P	12.	M.	ABSENT
46	B. M.	M. 464.P	10	M.	"
47	W. E	504.P	13.	M.	"
48	B. F.	446	10.	F.	"
49	J. M.	I. 2347	13	M.	"
50	G. D.	K. 735	10.	F.	PRESENT

TABLE OF SUBJECTS EXAMINED

Epiphysis present in 14 (28 per cent.) of subjects between the ages of ten and seventeen. Of those examined, 38 were boys, 12 girls. Of the 14 with epiphysis present, 10 were boys, 4 were girls.



Pen Drawings from Radiograms Showing Styloid Epiphysis

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PRIMARY TUMOR OF SACRUM

BY C. F. EIKENBARY, M.D., F.A.C.S., SEATTLE, WASH.

Primary tumors involving the sacrum are rather rare, which is the excuse for this report. The author has never before seen a primary tumor involving the bony structures of the sacrum, and in talking with various radiologists he has been surprised to learn that few of them have ever seen a primary tumor involving this particular bone.

J. W., aged seventeen, male, came under the writer's care on November 8, 1927, because of some pain and disability in the lower portion of his back, which had existed for the last year and a half or possibly two years. There was no injury preceding the development of this trouble. He located his pain low down in the lumbar spine. The onset was very gradual, and gradually he noticed that the region of the sacrum was becoming very much more prominent. At the time he came under the care of the author, he had lost a great deal of weight, but this was due to his having undergone a very strenuous dietary treatment, whereby he was put through a sort of starvation cure.

Examination showed that he was very much undernourished, weighed a little less than 120 pounds; musculature was very poorly developed; heart and lungs were negative; no other findings of any consequence, excepting those that referred to the lower portion of his back. The sacrum was exceedingly prominent, the prominence being rather dense and rather painful to pressure, non-fluctuating. Movements of the spine were slightly limited and were associated with a moderate amount of pain. The Wassermann was negative.

The radiograph of the sacrum showed that there was a dense, mottled shadow, covering the lower half of the sacrum and extending slightly beyond the middle line. The tumor mass involved the entire thickness of the sacrum, as will be noted by examining Figure 2. There was quite a considerable amount of this same dense tissue, anterior and below the prominence of the sacrum. The radiologists made a diagnosis of a benign tumor, possibly an osteochondroma.

In order to establish a definite diagnosis, the patient was submitted to an exploratory operation and portions of the sacrum, posteriorly, were removed. These sections were run through the laboratory and showed an osteofibrochondroma. No operative treatment was recommended.

FIG. 1

J. W. Anteroposterior view. Note the tumor mass, involving the lateral half of sacrum.

FIG. 2

J. W. Lateral view shows tumor mass, involving entire thickness of body of sacrum, and extending posterior to and below the sacrum.

END RESULTS IN TRANSFERENCE OF THE CREST OF THE ILIUM FOR FLEXION CONTRACTURE OF THE HIP*

BY JAMES S. SPEED, M.D., MEMPHIS, TENN.

Flexion contracture of the hip may be due either to disease of the bony structures of the hip or to disease of the soft parts, muscles, and fascia, surrounding the joint. Only the latter type are to be dealt with in this report, except where contractures of the soft parts formed a definite obstacle in the correction of the bony deformity.

The following report is based on the study of a series of one hundred cases of flexion contractures of the hip, operated upon during the last six years by the author or his colleague, Dr. Willis C. Campbell.

By far the greatest number of flexion contractures of the hip, due to disease of the soft parts, are the result of the residual paralysis in anterior poliomyelitis, eighty-five per cent. of this series. The other fifteen per cent. are about equally distributed among spastic cerebral paralysis, infectious arthritis, and tuberculosis.

Anterior poliomyelitis	85 per cent.
Spastic cerebral paralysis	7 " "
Infectious arthritis	4 " "
Tuberculosis	4 " "

Flexion contractures, many of an extreme degree, are a rather frequent deformity in the infantile paralysis cases which present themselves for treatment. The relative frequency and the extent of the contracture are dependent upon two factors: first, the extent and location of the residual paralysis; second, the amount of preventive treatment which the cases have received.

Medical education of the public, particularly along orthopaedic lines, has just begun to be disseminated throughout our rural communities; consequently, in a majority of the cases, no attempt has been made to control or prevent deformities following infantile paralysis.

It is for this reason, perhaps, that we have a relatively higher percentage of extreme deformities than occur in other communities. It was soon apparent that the usual methods employed for the correction of the milder types of flexion deformities of the hip were entirely inadequate for the severer types, where the contractures had progressed to from forty-five to ninety degrees and were complicated by a fixed abduction contracture.

* Read before the meeting of the American Orthopaedic Association, Yosemite Valley, Calif., June 1927.

This was particularly true in the young adults where the condition had existed for fifteen years or more. It was for the relief of such cases that the operation reported by Dr. Campbell in 1922, was developed. The uniformly good results which have followed its use both in regard to correction of the deformities and to its freedom from operative shock, have led us to employ it in all cases now, where the flexion exceeds twenty degrees or where there is any abduction contracture.

Flexion contractures of varying degrees are common in all untreated cases of infantile paralysis where the gluteal and thigh muscles are involved. Although the milder types may be compensated for by an increased lumbar lordosis, this causes a definite disturbance in the body mechanics, throwing increased strain on the muscles and ligaments of the spine and pelvis and exaggerating the amount of scoliosis which so frequently complicates the condition.

When the hip contracture exceeds forty-five degrees the limb becomes practically useless for weight-bearing, and when both limbs are affected walking in the upright posture, even with the aid of crutches, is impossible and the quadruped position must be assumed.

A brief review of the normal anatomy and kinesiology of the muscles controlling the hip joint, as well as the pathological changes which occur in such diseases as anterior poliomyelitis, will give a clearer idea of the problem to be solved in the surgical correction of flexion contractures.

The movements of the hip joint are complicated; many muscles are often used to produce a single movement; and various muscles may assist in several different movements, depending upon the position of the thigh. Again, other muscles, such as the rectus femoris, act upon the hip only when their action on another joint has been completed or prevented. Thus it is evident that the normal action of certain muscles is altered or exaggerated in disease where certain groups are not functioning or when the limb is in an unusual position.

In the subject under discussion we are concerned chiefly with the four cardinal movements of the hip: flexion, extension, adduction, and abduction.

Flexors: There are two sets; one whose action is pure flexion, the psoas and iliacus. The function of the second group, composed of the tensor fascia femoris, pectineus, gluteus medius, sartorius, and rectus femoris, is chiefly accessory to the first, the latter two muscles acting only as flexors when their pull on the knee is prevented.

Extensors: There are four principal extensors; gluteus maximus, biceps femoris, semitendinosus, and semimembranosus, the latter three again acting on the hip only when flexion of the knee is prevented.

Abductors: These are the gluteus medius and gluteus minimus, also the tensor fascia femoris and sartorius when hip and knee are flexed.

Adductors: These include the adductor longus, adductor magnus, adductor brevis, and gracilis.

It is a recognized fact that usually only those muscles which have some living fibers in them develop contractures. Again, we know that

living muscles generally do not contract if their antagonists are actively pulling against them. Hence, in explaining the usual flexion abduction contracture of the hip, we must assume that the flexor and abductor groups are less extensively involved than their opponents, the extensors and adductors. This is especially true as regards flexion, as it occurs against the action of gravity.

Mitchell, in an analysis of the residual paralysis in three hundred and fifty cases of poliomyelitis, has shown that just this condition does most often occur.

The chief flexors, iliopsoas, sartorius tensor vaginae femoris, and rectus femoris are involved much less extensively than the gluteus maximus. The hamstrings have ceased to function as extensors of the hip, because the knee is usually in a fixed flexion contracture. The knee flexion has also made a strong hip flexor out of the rectus femoris, hence whatever strength there is in the flexors is almost unopposed. The rectus femoris is a very powerful muscle, and when allowed to become contracted with the hip and knee flexed, forms one of the greatest obstacles to extension of the hip.

With the hip flexed the power of the gluteus medius, reenforced by the active sartorius and tensor vaginae femoris, is sufficient to overcome the action of the weakened adductors.

INFLUENCE OF THE ABDUCTORS ON FLEXION DEFORMITY

Very little has been written about the rôle which the abductors play in flexion contractures. We all know, however, that many of these flexed thighs can be almost fully extended in the abducted position. There are two reasons for this:

One is that abducting the thigh shortens the distance between the pelvis and the knee and allows a certain amount of relaxation in the true hip flexors. This can be demonstrated easily when a limb is under traction, or on an orthopaedic table; if the foot bar is abducted the tension on the leg is lessened.

The other reason is that the gluteus medius is one of the accessory flexors of the hip, which has become contracted. Abduction shortens the distance between the greater trochanter and the ilium, relaxes this muscle and allows the hip to be extended. Most anatomies do not mention the gluteus medius as a hip flexor, but it was long ago demonstrated by Duchenne that the anterior portion of this muscle actively assists in flexing the hip.

Although the iliopsoas is usually not extensively paralyzed and undoubtedly takes part in producing the flexion contracture, it does not seem to assume as much of a fixed contracture as the other muscles. This is probably due to the fact that motion in the spine and pelvis provide sufficient opposing action to keep it stretched. At operation the fibers usually have a healthy, red color and detaching the iliopsoas from the

inner surface of the ilium gives sufficient relaxation to allow extension of the joint. In most cases it is unnecessary to divide it, and when this is done, the practical benefit as far as releasing the hip flexion is disappointing.

After the hip has remained in a position of fixed flexion contracture for a number of years, the anterior portion of the capsule of the hip joint becomes shortened and contracted, the iliofemoral ligament or "Y" ligament of Bigelow,—being the most resistant structure and standing out as a tense band when an attempt is made to extend the hip,—must often be divided in the severer cases of long duration before the thigh can be brought down.

From a practical standpoint the structures most actively holding the thigh in flexion, named in the order of the benefit secured by the release of each are:

1. Rectus femoris
2. Group around anterior superior spine: sartorius and tensor vaginae femoris.
3. Gluteus medius
4. Iliopsoas
5. Capsule of the hip joint.

The muscles most actively engaged in producing the abduction are:

1. Gluteus medius and minimus
2. Sartorius and tensor vaginae femoris

EXTENT OF THE DEFORMITIES

As previously stated, the extent of the flexion abduction deformity depends to a large degree upon the amount and the distribution of the residual paralysis. That this follows a rather constant pattern is evidenced by the fact that this deformity is by far the most common one encountered about the hip joint. We occasionally see completely flail hips where there is no contracture, or there are rare cases of pure abduction deformities, there being two such cases in this series. Paralytic dislocations occasionally occur in connection with flexion contractures, but they are more common in the straight hips with more extensive muscle involvement. Five per cent. of this series were complicated by paralytic dislocations.

An effort has been made to determine the relation of various factors, such as the age of the patient, duration of the disease, and the distribution and extent of the paralysis of the different muscle groups, to the production of flexion contractures of the hip. So many complications were encountered, such as lack of definite data in the examinations, and the patients' inability to give an accurate history, that an accurate summary could not be made. Certain general conclusions, however, could be formulated.

The degree of contracture appears to depend to a large extent upon the general muscle strength about the hip, the larger percentage of severe contractures occurring in those cases which were extensively paralyzed; apparently retaining only a small amount of power in the flexor and ab-

ductor groups. The true strength in the hip muscles as recorded at the preliminary examination was in all probability masked by the long period of disuse and deformity. This is indicated by the fact that many of these cases showed considerable improvement in muscle power after function was restored. In others, however, the marked weakness persisted indefinitely, necessitating the continued use of crutches in walking.

Completely flail hips developed little or no contracture.

In those where the general muscle strength was from twenty-five to fifty per cent. normal, milder contractures up to thirty degrees were the rule.

The age of the patient and the duration of the disease appeared to have very little influence upon the extent of the deformity. In the extreme cases the contracture begins during the first six months and usually reaches its maximum within two or three years. The series was arbitrarily divided into two groups: those below fifteen years, fifty-six cases; and those above fifteen years, forty-four cases. There were fourteen double cases under fifteen, making seventy hips. There were eleven double cases over fifteen years, making fifty-five hips.

Extreme contractures over sixty degrees occurred in twenty-four of the hips under fifteen, and in only eleven of those over fifteen years.

Moderate contractures from thirty to sixty degrees occurred in twenty-six hips below fifteen years, and in twenty-one cases above fifteen years.

Slight contractures under thirty degrees were almost equally divided, twenty in the former, and nineteen in the latter groups.

The relatively larger number of severe deformities below fifteen is probably due to the badly crippled cases coming in earlier for treatment. The age of onset in all cases of this series was under twelve years.

It is evident from the above that the degree of deformity is not materially influenced by the duration of the disease.

The extreme nature of the deformities and the serious disability caused by flexion contractures of the hip are shown by the fact that twenty-six per cent. of the patients in this series had never been able to walk in the upright posture, even with the aid of crutches. They got about either by crawling on the hands and dragging the legs or by walking in the quadruped fashion on the hands and knees.

Fifty-two per cent. used either one or two crutches, leaving only twenty-two out of the one hundred cases who were able to walk without support.

Both hips were involved in twenty-five cases, and a single hip in seventy-five cases.

The youngest patient in the series was five years of age, the oldest was thirty-three.

COMPLICATING DEFORMITIES

Scoliosis is a most common accompaniment of hip flexion contractures. In many cases the spinal muscles themselves are involved, the hip deformity only exaggerating the condition. Many of these patients have

such marked weakness in the spinal muscles that they cannot support the trunk, which necessarily interferes with the results from the correction of the hip deformity. As in other cases of paralytic scoliosis, it is much more severe in the adult.

FLEXION CONTRACTURES OF THE KNEE

This is also a very common accompanying deformity, and one which must be dealt with either before or at the same time as the hip is corrected. It is almost impossible to hold a hip in the hyperextended position while the knee remains flexed. The milder types up to thirty degrees can usually be corrected by an osteotomy in conjunction with the hip operation, but when in excess of this, they are best corrected before work on the hip is started.

Knee flexion of varying degrees was present in seventy-three of the cases.

SHORTENING OF THE EXTREMITY

This is usually present in all legs where there is an extensive paralysis. When the shortening is over one inch, it must be compensated if we wish to secure the best functional result in the hip and prevent a tendency to recurrence of the flexion.

TREATMENT

The earlier methods of treating these deformities, subcutaneous tenotomies and attempts at correction by means of apparatus, were entirely inadequate where any appreciable degree of flexion existed. All contracted structures must be loosened and the contracture fully corrected if recurrences are to be prevented.

The first procedure based on sound surgical principles was the operation described by Dr. Robert Soutter of Boston. His technique gave sufficient exposure of the major portion of the contracted flexor structures to allow them to be stripped loose, and partly cared for the abduction contracture. In the severer cases, where the flexion was over forty-five degrees, it was usually found that sufficient abduction and flexion contracture still persisted to prevent full extension of the hip in a position parallel to its fellow. To correct these cases, certain modifications of and alterations to the Soutter operation were developed and described by Campbell in 1922 under the title of "Transference of the Crest of the Ilium". (Southern Med. J., XVI, 289, Apr. 1923.) The operation has already been reported but it will be described again in order to stress certain important steps and modifications which its use in over one hundred cases has proved to be of great practical value.

The incision begins about half-way back on the crest of the ilium, extends forward to the anterior superior spine and thence downwards on the thigh, along the medial border of the tensor fascia femoris for about six inches. This gives complete exposure of all the structures around the lateral and anterior aspects of the hip joint and permits stripping loose,

FIG. 1

Position of deformity and skin incision

subperiosteally, the entire attachment of the gluteus medius to the lateral surface of the ilium.

The superficial and deep fascia are incised down to the crest of the ilium, and the anterior superior spine, with its muscular attachments, is chiseled off. The outer one-fourth of the iliac crest is chiseled off from before backwards. With a heavy periosteal elevator all of the muscles on the lateral surface of the ilium are stripped down subperiosteally to the upper rim of the acetabulum. With a sharp osteotome an area on the outer surface of the ilium about three inches long, just above and parallel

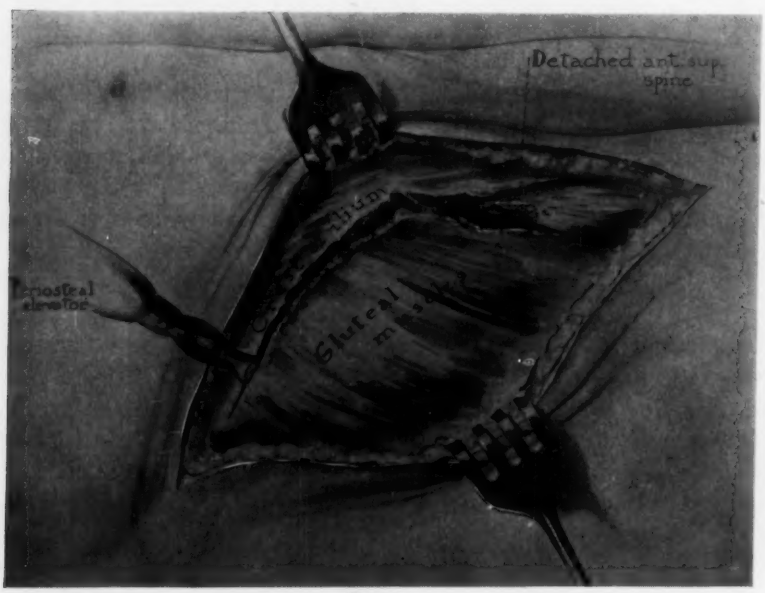

FIG. 2

Detachment of the anterior superior spine and the attachment of the gluteal muscles to the crest of the ilium.

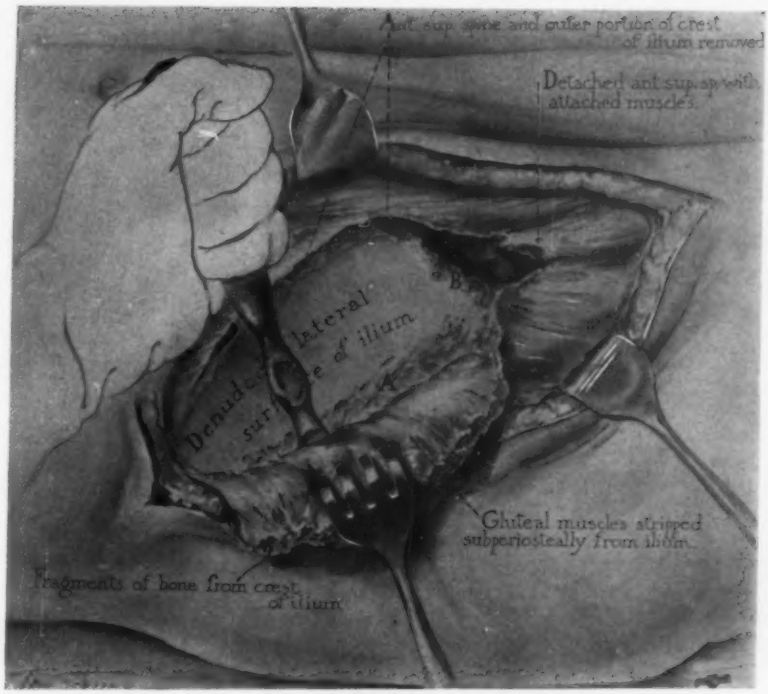
Ant. sup. spine and outer portion of crest of ilium removed
Detached ant. sup. spine with attached muscles
Lateral surface of ilium
Denuded surface of ilium
Gluteal muscles stripped subperiosteally from ilium
Fragments of bone from crest of ilium

FIG. 3

Gluteal muscles stripped subperiosteally from the lateral surface of the ilium. Area of roughening on the lateral surface of the ilium; attachment of the new crest at *A*.

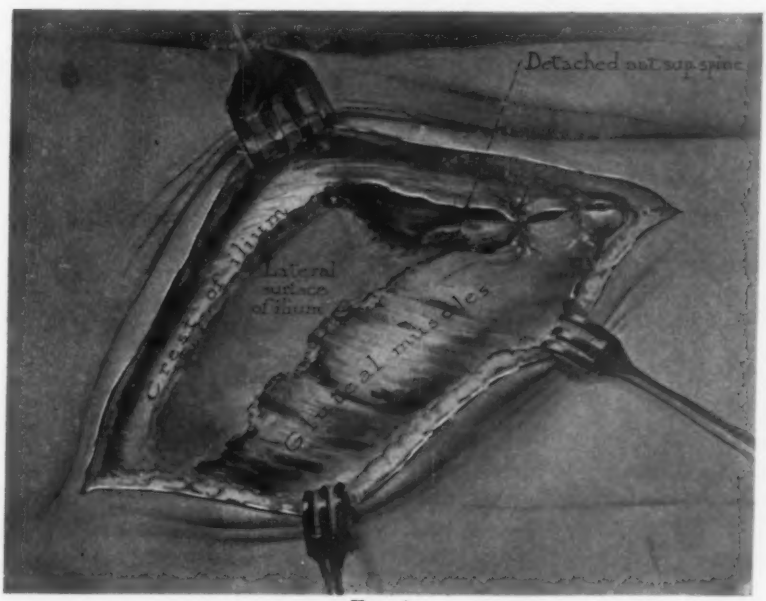

FIG. 4

Closure of the deep structures showing the new attachment of the anterior superior spine; edge of the gluteal muscles with attached bone rolled under the location of the new crest.

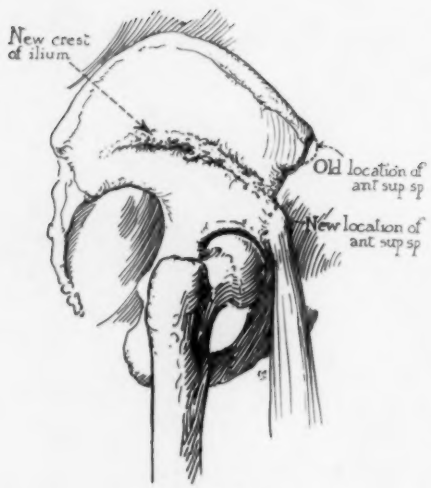

FIG. 5

Schematic drawing showing condition about one year after operation with the formation of new crest of ilium and attachment of anterior superior spine.

to the acetabulum, is denuded and roughened. This is to receive the gluteal muscles and bone removed from the iliac crest, and to form its new attachment.

This procedure is practically bloodless if one stays beneath the periosteum.

The attachment of the iliacus on the inner side of the ilium is next stripped loose in a similar manner, leaving the denuded ilium projecting into the wound.

The tissue between the anterior superior and anterior inferior spines is now stripped loose, exposing the attachment of the rectus femoris. It will be seen that very little of the flexion contracture has been released so far, and that it is the heavy broad tendon of the rectus femoris which offers the greatest obstacle to the correction of the deformity. This may be released either by stripping it loose from its attachments to the anterior inferior spine, or by the simpler and more effective method of extending the dissection and exposing about two inches of the tendon, passing a clamp behind and under it, and completely dividing the tendon over this clamp. The dissection is well outside the vessels and nerve, and if reasonable care is taken, no trouble will be encountered.

In most cases full extension of the hip in the adducted position can now be obtained, but occasionally it is necessary to divide the contracted fibrous tissue forming the anterior capsule of the hip joint, of which the iliofemoral ligament is the most resistant structure.

It is rarely ever necessary to divide the psoas muscle as it usually stretches down without difficulty. Its function should be preserved, if possible.

Before beginning the closure, about one-half to three-fourths inch of the anterior portion of the projecting iliac crest is removed and the bone smoothed off to prevent a troublesome protrusion caused by dropping the attachments of the gluteal and flexor muscles.

The anterior superior spine is placed against the ilium at about the level of the anterior inferior spine, and the fascia closed over it. When the crest of the ilium is reached, the deep fascia of the medial side is sutured to the subcutaneous tissue of the outer side. This serves the double purpose of rolling the gluteal muscles and the bone removed from the iliac crest downward to their new attachment just above the acetabulum, and of dropping the skin incision about one inch below the iliac crest, avoiding possible pressure.

A plaster spica cast from the axilla to the toes on the affected side is applied and allowed to remain on for eight weeks.

During this period of time the transplanted anterior superior spine and gluteal muscles have formed new bony attachments and are ready to resume their function in the new location.

The above operation, as described, perhaps sounds like a very formidable procedure, but the actual operating time is rarely over twenty minutes and there is very little loss of blood. Contrary to the gradually accepted idea, there has been practically no postoperative shock and there have been no fatalities in over one hundred and thirty operations.

A number of cases of alarming postoperative shock, and even some fatalities have been reported following other operative procedures where excessive tension is put on the soft structures. Other severe complications such as occlusion of the femoral artery and vein and paralysis or clonic convulsions in the muscles supplied by the anterior crural nerve have also been reported.

Various explanations for these complications have been offered. The general consensus of opinion is that they are caused by a too rapid correction of the hip flexion, resulting in a disturbance of the organs of the

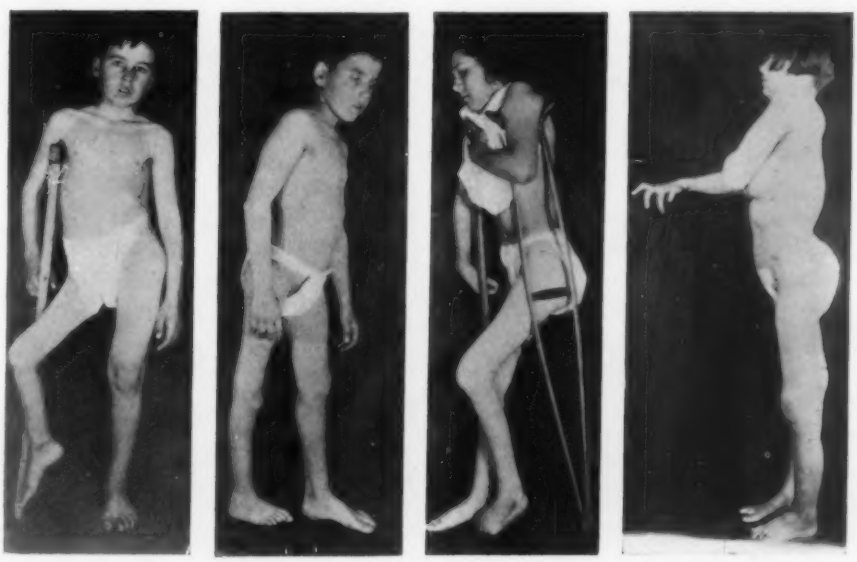

FIG. 6-A FIG. 6-B FIG. 7-A FIG. 7-B

Fig. 6-A. Single dangle leg type, with 45 degrees flexion contracture of right hip, requiring the use of one crutch.

Fig. 6-B. One year after operation, slight residual contracture. Walks without support.

Fig. 7-A. A bilateral flexion contracture of hips; right 30 degrees, left 45 degrees. Walked with difficulty on two crutches.

Fig. 7-B. Six months after operation, contractures completely corrected; beginning to walk without support.

FIG. 8-A

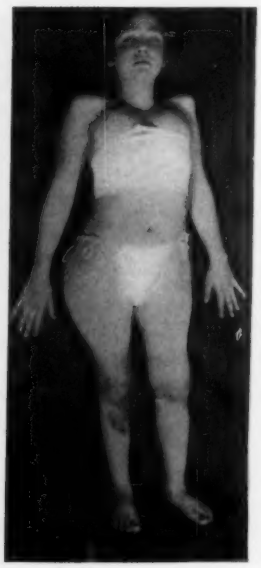

FIG. 8-B

Fig. 8-A. Fifty degrees flexion contracture left hip, some weakness in trunk muscles and extremely bad body posture.

Fig. 8-B. Marked improvement in posture following correction of hip deformity.

abdominal cavity combined with too great tension on the vessels and nerve. A certain amount of shock is also ascribed to the extensive nature of the operation itself.

It is our contention that the difficulties following the Soutter operation are not due to the fact that it is too extensive, but rather just the opposite, that it is not extensive enough. The same conditions hold here as in abdominal surgery. It is not the cutting of structures that cause shock, but the placing of undue tension upon them. We should not attempt full correction of a flexed hip unless all of the contracted structures have been fully loosened.

The more complete the operation the less postoperative shock there will be.

This is not mere theory nor conjecture, but is the conclusion drawn from the experience of operating on a large number of these patients, a great majority of whom had severe contractures of forty-five degrees or more.

We do not hesitate to fully correct contractures of sixty degrees or over, provided the loosening of the soft structures will allow the hip to come down without tension.

When the operation, as above described, is completed, most hips will drop down into a position of complete correction from their own weight, and a slight amount of hyperextension, which is desirable, can be secured with very slight force.

We never apply a cast with the soft structures under undue stress, nor do we make an effort to forcibly extend the hip during the operation. If full extension is not secured we go back and search further for any contracted structure which is holding it, and if this is not found, the cast is applied in a position of slight flexion, to be changed in ten days when the correction can be completed.

This two-stage operation is rarely necessary, having been done in only four cases of the entire series.

In only two cases was it considered necessary to give stimulation during the operation. Subcutaneous saline was administered to five patients after they returned to the room, all of whom promptly reacted and had an uneventful convalescence.

In no case has there been any sign of vascular or nerve injury.

There have been no fatalities in the entire series.

PROCEDURE IN BILATERAL CONTRACTURES

When both hips are involved it is usual to find some flexion contracture of both knees as well. If neither are severe we usually correct both the hip and knee on the same side at one operation. If both the hips and knees are severe we usually first correct one knee. After about two weeks a second operation is done, at which time the hip on the same side and the knee on the opposite side are corrected. After about four weeks the remaining hip is corrected.

In four double cases, where the contracture was under thirty degrees, both hips were done at one operation. These were all in young children and there was no postoperative shock.

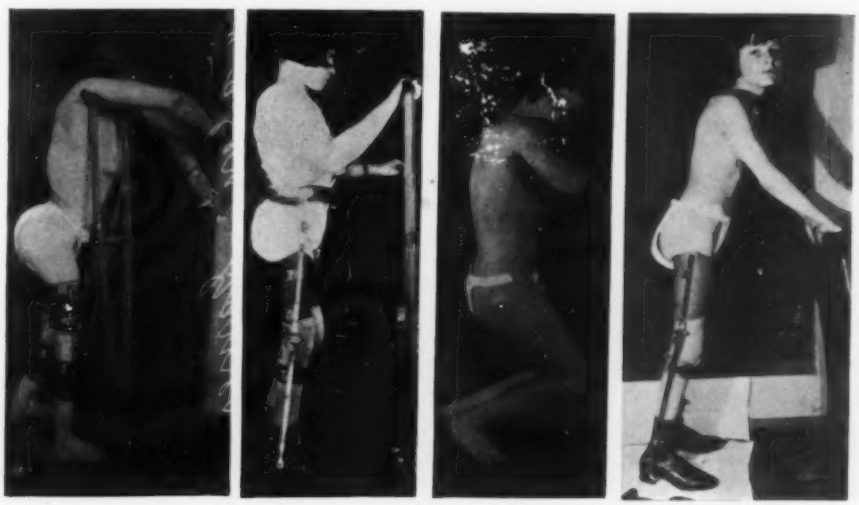

FIG. 9-A FIG. 9-B FIG. 10-A FIG. 10-B

Fig. 9-A. Bilateral flexion contracture of hips, extensive paralysis of both legs, and moderate weakness in spinal muscles. Walked very poorly on two crutches.

Fig. 9-B. One year after operation, hips completely corrected, marked improvement in body posture. Still requires braces and crutches due to extensive paralysis.

Fig. 10-A. Case of spastic cerebral paralysis; fixed contractures of both hips and knees.

Fig. 10-B. Immediate postoperative photograph. Complete correction of both flexion contractures. Patient later walked well without support of any type.

RESULTS

In analyzing the results from this operation we must take into consideration four factors:

1. Anatomical correction of the flexion contracture.
2. Improvement in the method of walking.
3. Influence on accompanying deformities, such as scoliosis.
4. Influence on muscular function.

ANATOMICAL CORRECTION

The correction is classed as:

A. Complete, when at the end of one year the hip could be fully extended in the adducted position.

B. Satisfactory, when there was not over fifteen degrees flexion.

C. Poor, when there was over fifteen degrees flexion.

The series was divided into three groups, depending upon the amount of flexion found before operation.

1. Mild, up to thirty degrees.
2. Moderate, from thirty to fifty degrees.
3. Severe, when over fifty degrees.

TABLE OF RESULTS

Group	No. of Cases	Complete		Satisfactory		Poor	
		No. of Cases	%	No. of Cases	%	No. of Cases	%
Group I 30° or under	43	41	95	1	2½	1	2½
Group II 30° to 50°	47	42	90	3	6	2	4
Group III. 50° or over	30	17	56.6	6	20	7	23.4

NOTE: There were 20 double hip cases.

SUMMARY OF TABLE

In the group of mild contractures, thirty degrees contracture or under, the results were complete correction in all but two cases. One had a recurrent contracture of ten degrees, but such good function that no further operation was necessary. The other had a recurrent contracture of twenty degrees, due to discontinuing after-treatment.

In the group of moderate contractures, thirty degrees to fifty degrees,

ninety per cent. were completely corrected, six per cent. were satisfactory, and in only two cases, or four per cent., were the results poor.

In the group of severe deformities fifty-six and six-tenths per cent. were completely corrected, twenty per cent. were satisfactory, making seventy-six per cent. of cases, due to all diseases, in which the operation satisfactorily accomplished the purpose for which it was done. If we

FIG. 11-A

FIG. 12-A

FIG. 11-B

FIG. 12-B

Fig. 11-A. Quadruped type. Poliomyelitis. Bilateral flexion contractures of hips; right 70 degrees, left 90 degrees. Good back muscles.

Fig. 11-B. Result six months after operation. Deformities corrected, walking in upright posture restored.

Fig. 12-A. Quadruped type poliomyelitis. Extensive paralysis involving legs and spinal muscles. Sixty degrees flexion contracture both hips.

Fig. 12-B. Six months after operation. Contractures corrected and upright posture restored, but still requires crutches and spinal brace because of weakness in back muscles. Fusion of spine advisable in this type of case.

exclude from this group two cases of tuberculosis and two of infectious arthritis, where the bony structures were involved, it leaves only three cases, or ten per cent. due to poliomyelitis where the results were not satisfactory. All of these had flexion contracture over seventy degrees and all were markedly improved, though they cannot be classed as satisfactory.

It is in this severe group of cases that we feel the operation is most valuable. These are the cases where correction by other operative procedures would have been impossible, and if attempted would have probably resulted in serious postoperative complications.

IMPROVEMENT IN METHOD OF WALKING

There were twenty-two cases that did not use a crutch or other support in walking before operation. Most of these had a very marked limp which was to a large degree due to the position of the hip, although other deformities in the knee and foot were partly responsible. Correction of the hip contracture materially improved the limp in all cases. In a few where there was marked gluteal weakness and body sagging, a Thomas ring was added to the brace to support the hip. Fifty-two cases used either one or two crutches. The necessity for crutches before operation was in many cases due to both the position of the hip and to marked weakness in the trunk and leg muscles; consequently many cases required crutches even after the hips were corrected.

Thirty-six of the patients who had never walked without crutches were able to discard them permanently.

The most striking group is that of the twenty-six who had never walked in the upright posture or who had never been able to get about in any way. All were put on their feet and were able to walk in the upright posture. Due to the extensive nature of the paralysis, usually involving both legs, support of some type was necessary in all. Seventeen needed only braces, while nine required both braces and crutches.

IMPROVEMENT IN BODY POSTURE

As previously stated, scoliosis was present more often and to a greater degree in the older cases. This would be expected because of the increased weight of the trunk and a longer existence of the posture of deformity. Twenty-three of the forty-four older patients and twenty-five of the fifty-six children had sufficient fixed scoliosis to be a material element in their deformities.

In eleven adults and seventeen children the fixed scoliosis was so slight after the hip contractures were corrected and the legs balanced, that after-treatment for the scoliosis was unnecessary.

Correction of the curvature and fusion of the spine in conjunction with the hip operation was done in five adults and three children, all with most satisfactory results. In twelve cases the curvature was of such marked

FIG. 13

X-ray taken about two years after operation, showing formation of the new iliac crest and attachment of gluteal muscles.

degree that correction was not attempted. It is felt that in many cases with a moderate degree of paralysis in the spinal muscles, severe scoliotic deformities can be prevented by early correction of the hip contractures.

IMPROVEMENT IN MUSCLE POWER

While it is not possible to tabulate this accurately, there is no doubt but that the general muscle strength in all the thigh groups improves after the limb is put in the position of function. It is most noticeable in the flexors and adductors. Gluteal weakness and a sagging or hip limp has persisted in cases when there was much paralysis in these muscles. In no cases however do we feel that the lowering of the gluteal attachments has increased this weakness. The new attachments are as strong as the original, and, if sufficient active muscle fibers are present, improvement occurs just as in the other groups.

CONCLUSIONS

1. The usual deformity in paralytic contractures of the hip is due to flexion and abduction.

2. The abduction contracture must be corrected in the severer cases before full correction of the flexion can be obtained.

3. Postoperative shock is usually due to tension on the soft structures about the hip which have not been sufficiently loosened.

4. The more complete the operative procedure the less the postoperative shock.

5. The results from the above operation are satisfactory both in regard to the correction of the deformity and to its freedom from postoperative complications.

6. The operation is indicated in cases where the flexion exceeds twenty degrees.

DISCUSSION

Dr. M. S. Henderson, Rochester, Minn.: Dr. Speed has presented his subject so well and the pictures show so clearly the points he wishes to make that there is little to add. We have found this operation of Dr. Campbell's particularly useful in severe cases and in those cases in which there is abduction present. Sometimes it is necessary to divide the rectus femoris, and in some cases we have found it necessary to divide the iliopsoas.

The advantage of this operation is that you do not cut the muscle, you merely move the origin of the muscle to a lower level.

Dr. Frank D. Dickson, Kansas City, Mo.: I know we are all very much interested in this presentation because it is attacking a problem which we ourselves are facing constantly. There is no question but what flexion deformity does interfere with locomotion. I have had no experience with this method which Dr. Speed and Dr. Campbell use, though I have seen their results and can vouch for its efficiency. I think, as Dr. Speed does, that its efficiency is due to the careful widespread freeing up that is done in this procedure and the lessened tension and consequent shock in this operation.

I find myself at variance with Dr. Speed regarding the gluteus medius. Granting that the anterior portion of the gluteus medius is the hip flexor, it has been my fortune to find the gluteus medius usually paralyzed and if not paralyzed, usually weak. You find the fascia lata contracted and the tensor fascia femoris very strong, because we know that the tensor fascia femoris usually escapes in infantile paralysis. Soutter usually divided the tensor fascia femoris to obtain the necessary length to let the hip come down. It is my feeling that this contracture of the tensor fascia femoris as a whole is more important than contracture of the gluteus medius in causing deformity.

The Soutter operation and the one Dr. Speed described depend for their improvement on two things, the removal of the contracture and secondly, the placing of the muscles in a position where they may have the best function. I feel that both these operations could have something added to them. It strikes me that some of them are like lengthening the whole tendon in the foot without stabilizing the foot. We have been transplanting the tensor fascia femoris from the anterior superior spine to the posterior superior spine. By this procedure, we relieve the contracted structures and aim to get some extensor force back of the hip joint, thus helping to get stability of the hip. We have been fairly well satisfied with it.

I think this procedure which Dr. Speed has described is a most useful one and certainly one which is going to help out a lot in correcting these bad deformities, as he has shown, particularly those at forty-five degrees, which the Soutter operation does not very often allow us to correct adequately.

Dr. Leo Mayer, New York, N. Y.: We all expect good work to come from Willis Campbell's clinic in Memphis and we are not disappointed in the presentation today. We all congratulate him very warmly because of his results and also on Dr. Speed's presentation of his cases.

On my way West I stopped in the Middle West to visit Dr. Dickson, and I want to report here that it seems to me that his transference of the tensor fascia is of decided value in these cases. You are not merely subtracting the flexor effect, you are also adding to the power of the extensor group. It is surprising to see after the Dickson operation how some of the extensor power returns in the gluteal muscles which were apparently completely paralyzed. You get stability in the hip by that operation which, it seems to me, is not gained by the simple division of the flexor muscle. I cannot see any reason why the Dickson operation could not be combined with the procedure of Dr. Campbell. I for one am certainly going to try it.

Dr. J. S. Speed, Memphis, Tenn. (Closing the discussion): I have nothing to add except to state something that we did not get to in the paper. We feel in transferring the attachment of the gluteal muscle that we do not detract from the muscle power, but that we add to it. I am thoroughly in accord with Dr. Dickson and Dr. Mayer regarding the transplantation of the muscle. I think one disadvantage is that there is not enough hip power left. Anything that will increase the hip power is of value. I think the addition of Dr. Dickson's plan to this procedure will be very valuable. We have used it in some cases and expect to use it more.

In regard to the action of the gluteus medius, I agree with Dr. Dickson that the gluteus medius is frequently and usually quite extensively paralyzed and for that reason it is contracted, and undergoes the fibrosis of contraction. From this contraction it prevents the hip from going down in complete extension. Part of the fibers that act as flexors also prevent the complete adduction of the hip. Anything that loosens up the latter structure will aid in bringing the hip into adduction and aid in relieving the flexion contraction.

I wish to thank the gentlemen for their kind discussion.

A CASE OF BILATERAL CONGENITAL FUSION OF THE CALCANEI AND CUBOIDS

BY GEORGE W. WAGONER, M.D., HAVERFORD, PENN.

From the Orthopaedic Section, Graduate School of Medicine, University of Pennsylvania, Philadelphia.

Congenital fusion of two or more tarsal bones is sufficiently infrequent to warrant reporting.

A case of bilateral fusion of the calcaneus and cuboid is here presented.

CASE REPORT

L. F., a white boy, nine years of age, was admitted to the Orthopaedic Clinic of Dr. DeForest Willard at the Graduate Hospital, August 20, 1926.

The patient complained of severe pain in both feet which was present on awakening, but which disappeared following exercise. The parents of the child were concerned by the extreme prominence of both internal malleoli. The pain had been present for several years; it was not induced by walking or exercise and was absent in the evening following an active day. The protuberance of the internal malleoli was first noted a year before admission.

Physical examination showed that the feet were pronated and everted. The scaphoids and internal malleoli were extremely prominent, especially on the right. Both the internal and external longitudinal arches were obliterated. The peroneal tendons were dislocated anteriorly. It was impossible to abduct the feet either actively or passively. There was neither swelling nor inflammation of the soft parts. Pressure over the right internal malleolus was painful.

A history of the ordinary diseases of childhood was obtained. There was no history of "rheumatism," prior joint involvement, swelling or inflammation of the ankles, frequency of urination or nocturia.

An elder sister suffered from congenital dislocation of the hip.

X-RAY EXAMINATION

The roentgenographs revealed an obliteration of both calcaneocuboid joint cavities with a solid bony fusion of these two bones. All other joint spaces were clear and no evidence of arthritic change was noted.

Viewed laterally both astragali were displaced forward and downward and their superior surfaces rotated inward.

The calcaneus and cuboid of each foot were tilted downward; both bones were somewhat flattened from above downward and they were rotated counter-clockwise on their long axis.

The two calcanei presented in the lateral view other distinct deformities. The sustentacula tali were flattened; both the internal and external plantar tubercles were diminished in size, while the peroneal spines were markedly enlarged. Instead of an obtuse angle at the junction of the posterior wall of the posterior facet with the body of the os calcis, a deep distinct notch was found at this point.

The main bone trabeculae, instead of being radially arranged with their center at the posterior facet, were found to be most numerous and distinct along the inferior lateral aspect of the two calcanei. In this position the trabeculae paralleled the longi-

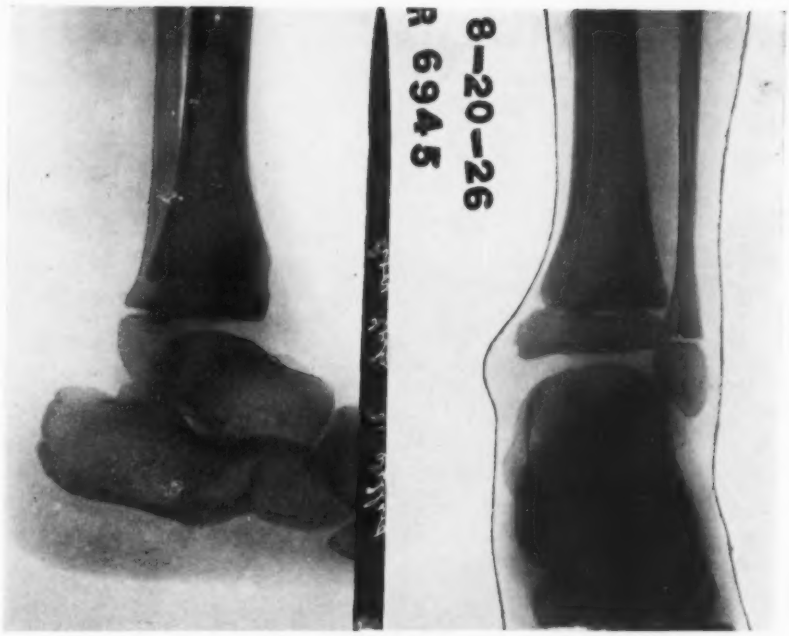

FIG. 1

Roentgenograph of the right lower extremity*

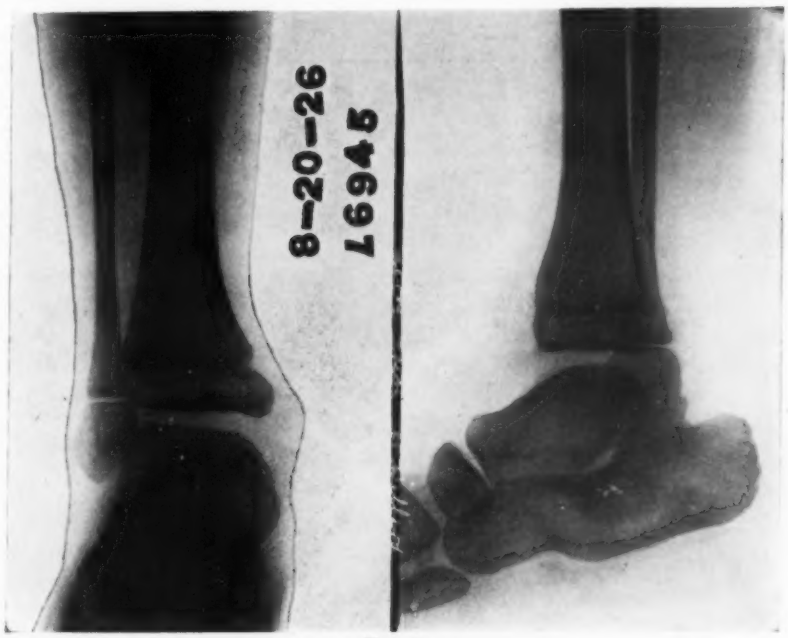

FIG. 2

Roentgenograph of the left lower extremity*

*The x-rays of both anteroposterior views show the prominence of the internal malleoli, and to demonstrate it more clearly the skin surfaces have been outlined.

tudinal axis of the bone, sweeping in long graceful curves from before back with their convexity downward and their apices just posterior to the peroneal spines.

No joint spaces were discernible between the calcanei and cuboids. A line of demarcation formed by reflected bone trabeculae marked the normal site of the joint spaces. In the right foot the line of demarcation extended the entire distance in the vertical plane. The left foot showed a less well defined line between the calcaneus and cuboid and one which extended upwards but half the normal distance.

The marked prominence of the internal malleoli and scaphoids was clearly shown by the skin line in the anteroposterior films.

DISCUSSION

In order that fusion may occur between two articulating bones, it is necessary that the articular cartilage between them be absent. Absence of the articular cartilage may be congenital or may be due to destruction by disease processes.

It is difficult in this case to rule out infection as the cause of the absence of the two calcaneocuboid articular cartilages. The absence of arthritic changes in the other tarsal articulations is strong evidence against an infectious agent.

On the other hand embryology offers strong evidence in favor of congenital absence. In the development of the human foot the tarsal cartilages first appear in an embryo of about fourteen millimeters in length. The tarsal joint cavities begin to develop when the embryo is between twenty-five and thirty millimeters in length (sixtieth day); in a foetus of approximately fifty millimeters definite tarsal joint cavities are present[1]. The formation of the joint cavity begins at the margins and extends toward the center of the joint[2].

Ossification of the calcaneus begins about the sixth uterine month while ossification of the cuboid does not start until birth[3, 4].

It is interesting to note that the calcaneocuboid joint cavity is not connected with any of the adjoining tarsal joints[5].

The fact that the calcaneocuboid joint cavity does not join with any of the neighboring tarsal joint cavities bespeaks an independent origin and growth of the articular cartilage of this joint. The difference in time of ossification of the os calcis and cuboid, the bilateral fusion of these two bones, the arrangement of the bone trabeculae, and the uniform distortion and deformity of the calcaneus and cuboid in the two feet suggest congenital absence of the two calcaneocuboid articular cartilages.

SUMMARY

1. A case is reported of bilateral fusion of the calcanei and cuboids occurring in a boy of nine.

2. Evidence of arthritic involvement of the tarsal articulations is lacking.

3. Data is induced to show that fusion between the two calcanei and cuboids resulted from the congenital absence of the calcaneocuboid articular cartilages.

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REPORT OF A CASE OF BILATERAL FRACTURE OF THE FEMORA WITH AN UNUSUAL MALUNION*

BY ALONZO MYERS, M.D., CHARLOTTE, NORTH CAROLINA

The following case report is presented because of the unusual malunion following fractures of both femora.

Family history: Father and mother living and in good health. Several brothers and sisters living in good health. (No history obtained of a death in the immediate family.)

Past history: J. M., colored, age twenty-six years, single. Born in a tenant house in a remote rural district in eastern North Carolina. History given by father. Delivered by a "Granny; no trouble". The patient has never been sick; he walked early. At the age of about two and one-half years he fell off a porch down a flight of steps (only a few), and received an injury to his legs, but the parents did not consider it serious enough to call a doctor. About three years later he broke his arm, for which a doctor treated him. Until the writer saw him at this time he had never been examined by a doctor for the deformity of the legs. He is able to carry on the duties of a farm laborer, such as plowing, without pain.

Personal history: Temperate in habits, but uses tobacco moderately. No history of venereal diseases.

Present history: Reported October 1, 1927, for examination at the State Vocational Rehabilitation Orthopaedic Clinic, which is sponsored by the Charlotte Rotary Club and held monthly at the City and County Health Department, Charlotte.

Physical examination: Presents a well nourished patient, apparently in excellent health, except for the deformity of both legs and right arm. Heart is normal in size, no murmurs. Pulse 70. Respiration 20. Blood pressure normal. Does not complain of any pain. Lungs—negative. Abdomen—negative.

Laboratory work by Todd, Charlotte, N. C.: October 7, 1927. Urine: Acid, glucose negative, albumin negative. Sediment: An occasional pus cell, no blood, no casts, no bacteria, considerable amount of mucus.

Blood: R.B.C. 3,250,000
W.B.C. 9,050
Hgb. 6.3 gm. per 100 c.c. (37 per cent. Sahli).

October 8, 1927. Blood of October 7: Wassermann—negative. Kahn—negative.

Examination of right arm: Large amount of callus is palpable about the elbow joint. There is some shortening of the humerus and a limitation of motion in the elbow to flexion, extension, supination, and pronation. X-ray shows a fracture of the humerus just above the elbow, and there is considerable inward and forward bowing of the bone, but the union is good. (This condition is not discussed further as it has no bearing on the subject of this report.)

Examination of lower extremities: Both thighs show horn-like protuberances about three inches in length, which stand out about one and one-half inches in front of the lower lateral quadrants of the abdomen. Over the ends of these protuberances is seen marked callus formation and general thickening of the skin and soft structures due to pressure. There has never been an abrasion of the skin. On first examination without the x-ray, it appeared that there had been fractures of the upper thirds of both femora, the lower fragment over-riding, and a lateral anastomosis had taken place with the

*Shown as a clinical case report before the Mecklenburg County Medical Society, October 6, 1927.

FIG. 1

Front view. Shows practically normal alignment from the anterior superior spines to the internal malleoli. Note the bone protrudes through the muscle, yet the skin remains unbroken.

FIG. 2

Lateral view. Shows a horn-like prominence where the two fragments unite.

FIG. 3

Posterior view. Extreme shortening represented by the comparatively short distance between the gluteal fold and the popliteal space.

upper fragment in the position of ninety degrees flexion and some external rotation. Such union would be unusual but possible. However, the x-rays show an even more unusual condition. The upper fragment has flexed and rotated through an arc of 180 degrees. The child no doubt was walking all the time, so that the lower fragment has displaced upward several inches, and partially approximated the rotated upper fragment, so that a firm union has taken place. The photographs (by Meggs) and x-rays show practically normal alignment from the anterior superior spine to the internal malleolus, despite the anteroposterior distortion, and the extreme shortening which has taken place, as is represented by the short distance between the gluteal fold and popliteal space on each leg.

X-ray report:

"Right arm: There has been a fracture of the humerus just above the elbow and there is considerable inward and forward bowing of the bone, but the union is good.

"Spine: There is considerable forward displacement of the fifth lumbar vertebra.

"Femora: There is an old fracture in the middle third of the shaft of each femur with the upper fragments rotated forward and upward to an angle of almost 180 degrees. There is firm union of the fracture on the right and fair on the left in this position."—*Lafferty and Phillips, Charlotte, N. C.*

This report seems to give conclusive evidence that the deformity is not of congenital origin, and, although the acquired deformity is extreme, nature has assisted wonderfully

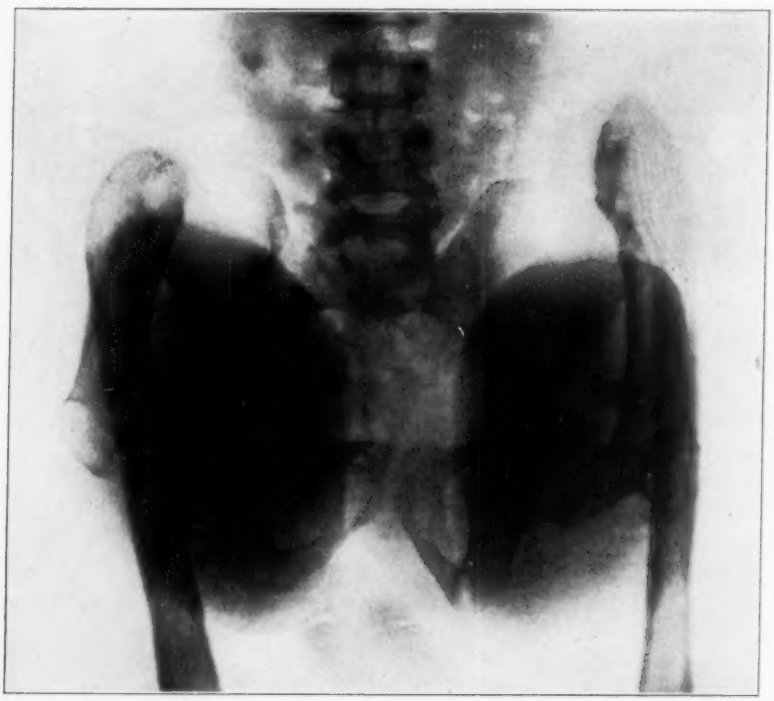

FIG. 4

Radiogram anteroposterior view. Note the extreme flexion and rotation of the upper fragment which brings the fractured ends together at a very acute angle. Firm union is seen on the right and fair union on the left.

FIG. 5

Radiogram of the right femur at a different angle, showing the solid union.

in producing at least functional results. No treatment was advised, owing to the fact that the deformity is so extreme and the duration over twenty years; the patient is without pain and able to do almost anything. He was turned over to the North Carolina Vocational Rehabilitation Department, where he will be kept under the observation of the author and trained as a cobbler by the department.

MARCH FOOT, WITH FRACTURE OF METATARSAL BONE*
REPORT OF CASE

BY S. E. GOLDMAN, M.D., MONTREAL, CANADA

Assistant, Department of Orthopaedics, Montreal General Hospital

Fractures of the metatarsal bones due partially to indirect violence are not uncommon, and are very often overlooked. Fractures of this type usually met with are those occurring in persons participating in strenuous athletic activities, such as running, jumping, tennis, professional dancing, and wherever violent muscular effort, involving the feet, is required. As the initial trauma in many of these cases may be very slight, the fractures so produced may pass unnoticed, unless routine x-rays are taken.

A most interesting and not unusual fracture of this type is that which may occur in the condition known as march foot. An excellent description of this condition is that of Sir Robert Jones[1]. He states, "An interesting fracture is that of the middle of the shaft of the second or third metatarsal bone, which may be due to a trivial accident to the foot in ordinary walking, as, for example, in soldiers on the march. No displacement occurs, and the patient may be unaware of its existence; a little pain and tenderness, and puffiness on the dorsum of the foot, are all the symptoms, and an unsuspected fracture is revealed by the routine skiagraphic examination."

The conditions leading to the onset of march foot, namely, long forced marches with heavy kits, are most likely to be found in the army. Hence it has become a well known phenomenon to military surgeons. Heretofore nearly all references to march foot and cases described are cited as occurring in soldiers on the march, although the possibility of its occurrence in civilians has been mentioned. Its incidence in civilian practice seems to be sufficiently uncommon to merit the following case report.

A. S., male, aged twenty-nine. Occupation, peddler.

When first seen, complained of pain and swelling of the right foot for past three weeks. For about ten days previous to onset of trouble he had been walking about ten miles daily, along country roads. He carried on his right shoulder, a pack containing his wares, which weighed about eighty pounds. The pain in his foot came on gradually, and finally he had to cease working. There was no history of injury. On this point he was quite positive.

On first examination he was wearing a carpet slipper, and carrying a cane, and could hardly bear weight on the right foot. The left foot was normal. Examination revealed moderate diffuse swelling of the dorsum of the foot, with marked tenderness over the region of the second metatarsal. Movements of the foot were normal, but there was definite evidence of weak feet.

*From the Department of Orthopaedics, Montreal General Hospital. Service of Dr. J. A. Nutter.

As the disability seemed to be out of all proportion to the physical findings an x-ray was advised. On superficial examination this appeared to be negative, but closer inspection revealed an incomplete, oblique fracture of the shaft of the second metatarsal, on its medial aspect. It was evident we were dealing with a case of march foot, with a fracture of the second metatarsal. A second x-ray was taken three weeks later, that is, six weeks from inception of his trouble, and this showed beginning callus formation about the site of the fracture, thus removing any doubt as to the diagnosis from the original plate. A plate, taken at a still later date, three months following the commencement of disability, showed extensive callus formation, with marked thickening of distal half of the shaft of the metatarsal.

The treatment was comparatively simple. Under a regime of rest, baking, and massage, the condition cleared up completely.

The interesting features to note in this case are the occurrence of an isolated fracture of a metatarsal bone in the absence of any history of injury, and the mode of onset, under conditions approximating closely those which exist in military service.

Although march foot appears to have been well established as a clinical entity, a review of the English literature reveals little mention of this interesting condition. With the exception of a recent article by Murk Jansen, the author has been unable to find any other references in the literature of recent years. References to march foot, in connection with fractures of the metatarsals, can be found chiefly in the text-books on orthopaedic and

FIG. 1

Showing incomplete fracture of shaft of the second metatarsal, on its medial aspect.

FIG. 2

Showing beginning callus formation about site of fracture, three weeks later.

general surgery. Sir Robert Jones, already quoted, gives an excellent description. Whitman[2] mentions the possibility of fracture of a metatarsal, in which no cause, other than walking, can be demonstrated. Jones and Lovett[3], speaking of fractures of the metatarsals, refer to march foot, and ascribe to it, the name, "*pied forcé*"[4]. This was the name given to march foot by the French authors, who were among the first to recognize and describe this condition. Pauzat[5] described *pied forcé* as early as 1887, and was followed at a later date by various other French and German observers. In 1899 Boisson and Chapotot[6], military medical officers of the French army, reported a study of *pied forcé* (march foot), and concluded that it was caused by marching, in the manner in which it was carried out by soldiers, namely, for prolonged periods, and loaded with heavy equipment.

Murk Jansen[7] in his recent article discusses march foot thoroughly, and gives us a much clearer concept of this condition than has heretofore existed. He cites several cases, illustrating the typical syndrome that occurs. He also offers a new theory as to the actual causation of march foot. He states his belief, that essentially march foot is the result of overfatigue in weak feet. This overfatigue, he asserts, results in spasm of the interosseous muscles, which in turn causes blood and lymph stasis in the tissues of the feet. As a result of this blood and lymph stasis, there is swelling of the soft parts, and brittleness of the bone tissue, leading eventually to fracture. This explanation is very plausible, and would seem to explain the occurrence of these fractures. It is interesting to note that march foot may and does occur without fracture of the metatarsals, which is usually a later development.

The case herein reported is considered of unusual interest, inasmuch as the condition occurred in a civilian, a comparatively uncommon occurrence. Thus, where the history is so suggestive, explanation of an otherwise obscure disability of the feet should be rendered simple.

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THREE TYPES OF BONE SARCOMA WITH CASE REPORTS

BY WILLIAM ARTHUR CLARK, A.M., M.D., PASADENA, CALIF.

With the idea that autopsy reports correlated with clinical course and roentgenogram findings may be of value to others, the following cases are reported:

CASE 1. Female, age seventeen.

Personal History: Hurt right knee in May 1924, when she was thrown from a car. Knee struck pavement on outer side. Limped for about two months, but not off her feet. Knee was swollen with fluid. This knee has been larger than the other ever since.

Present Illness: July 9, 1925, stepped off a rock about eighteen inches, throwing most of weight on right foot. Felt and heard something crack in right knee and sat down. Could not stand or walk on that leg thereafter. Swelling came on rapidly.

Examination: Throat, lungs, heart, and abdomen showed nothing abnormal. Right knee was swollen and tender. Could not stand manipulation. Tenderness was most acute over the external condyle. The leg lay in flexion at about 150 degrees. Roentgenogram report as follows: "Benign giant-cell tumor, lower end right femur. Pathologic fracture, external condyle." Urinalysis: Occasional leucocytes and rare red cells. Blood count: R.B.C. 4,340,000; W.B.C. 12,850. Hemoglobin, 80 per cent.

Operation, July 11, 1925. This operation was undertaken for the purpose of reducing the external femoral condyle which was so far displaced that a functional knee could not be hoped for without restoring it to anatomical position. Since the roentgenologic and clinical signs indicated giant-cell tumor, curettage with tourniquet was done.

FIG. 1

Case 1. At time of pathologic fracture.

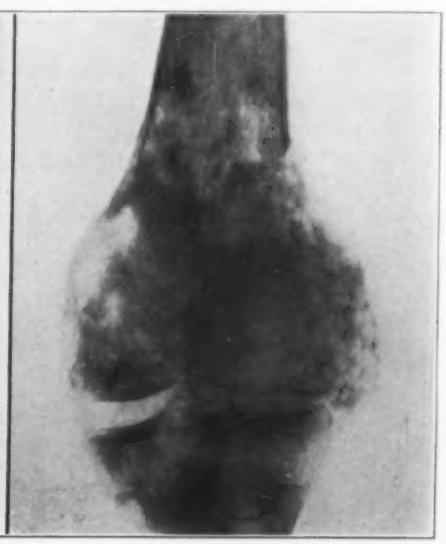


FIG. 2

Case 1. Autopsy specimen ten months later.

FIG. 3

Case 1. Tissue from sarcoma of femur. Magnification, 100 diameters.

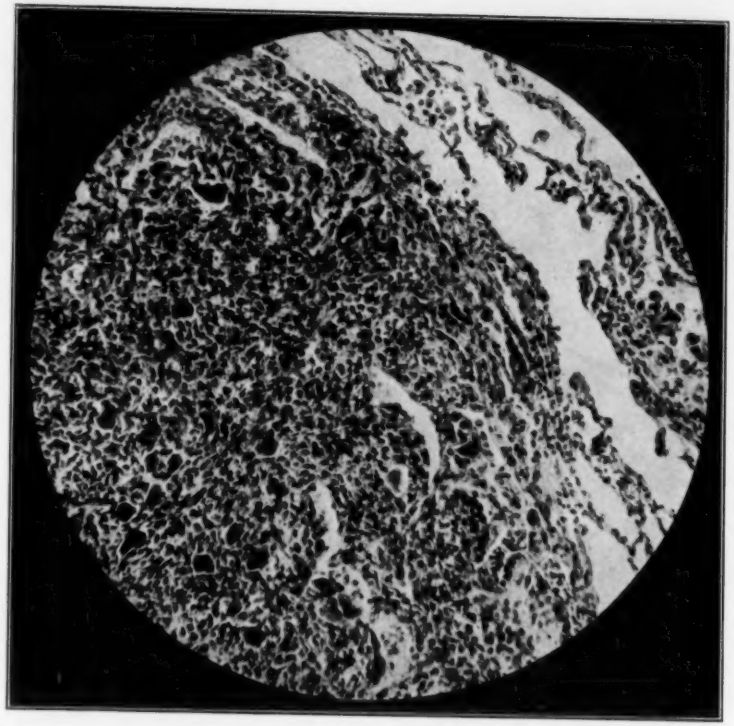


FIG. 4

Case 1. Metastatic sarcoma of lung. Magnification, 100 diameters.

FIG. 5

Case 1. Metastatic sarcoma of spine. Magnification, 100 diameters.

The shell of the external condyle was lashed to the inner condyle with kangaroo tendon, through drill holes. Immobilization in spica cast.

Pathologist's report: "Very vascular spindle-cell sarcoma. Low grade of malignancy with tendency to recur."

As soon as this unfavorable report was obtained, a course of deep roentgen-ray treatment was started. Three such courses of nine treatments each, were given during the next three months.

September 30, cast off. Walking on crutches. Able to bear a little weight on right leg.

January 20, 1926: Right knee somewhat red and tender. Nodule in left gluteal region about one centimeter in diameter, rather hard and tender. Amputation advised but refused.

February 26: Knee warm and tender, especially over condyles. Tenderness over outer malleolus of right ankle, over the ribs in the right back at scapular angle and in left gluteal region. General weakness and loss of weight. Anorexia. Has been in bed two weeks.

March 20: Losing sensation and motion in legs and control of bladder sphincter. Knee growing larger and more tender.

April 16: Complete paralysis below hips. Has to have retention catheter.

May 11, 1926: Died. Terminal pneumonia.

Autopsy report summarized as follows:

Femur: The lower end of the femur including the knee joint was removed. Section of the lower end of the femur shows a growth causing diffuse enlargement of the condyles.

This growth is in some places soft in consistency and hemorrhagic. It involves the knee joint, but the tibia is not involved. There is some deposit of new bone.

Lungs: Filled with small soft nodules, greyish white, about one centimeter in diameter. Some of these nodules resemble bone.

Ribs: Fourth, fifth, and sixth ribs in the right axillary line, show a tumor mass about two and five-tenths centimeters in rough diameter.

Heart and liver apparently normal.

Stomach and gall bladder, distended.

Pancreas firm, hard and woody.

Spleen, chronic splenitis.

Kidneys, pyonephrosis.

Bladder contracted, walls thickened. Contains small amount of pus. Mucosa gangrenous.

Spine: A bony tumor two centimeters in diameter was removed from the left lateral aspect of the body of the third lumbar vertebra.

Microscopical examination: Tissue from the tumor in the distal end of the femur, shows a very vascular spindle-cell sarcoma.

Tissue from the lung nodules shows spindle cells, small round cells, and numerous giant cells. In one nodule is a small group of cells resembling bone. Other nodules, on being decalcified, show dense bone deposits through which are dispersed spindle cells resembling those of the original femur tumor.

Tissue from the rib tumor: Vascular degenerating spindle-cell sarcoma.

Tissue from the vertebral tumor: Bony, with invasion by spindle cells and few giant cells.

Autopsy diagnosis: Spindle-cell sarcoma of the femur with metastases in the spine, lungs, and ribs. (By Dr. B. F. Sturdivant.)

Case 2. Female, age sixty-six.

Family History: Nothing of significance.

Personal History: Had a tumor removed from the pelvis several years ago. Had phlebitis in the left leg forty years ago.

Fig. 6

Case 1. Sarcoma of femur at knee. Picture taken seven months after pathologic fracture and about two years after original injury.

Present Illness: Aching and weakness in the region of the left hip for nearly two years.

July 23, 1926, broke left hip as result of slight trauma. Was being helped into bed when she heard and felt something break in the left hip region. Suffered severely following this.

General examination at the time showed: Tonsils imbedded and cryptic. Heart, nothing abnormal. Blood pressure, 160/76. Lungs, nothing abnormal. Abdomen, questionable mass in upper left quadrant. Left leg in external rotation and very tender in hip region on manipulation, otherwise the leg seems normal.

Wassermann, negative.

Red cell count, 4,740,000; white cell count, 8,700. Hemoglobin, 75 per cent. Urinalysis, negative.

Roentgenogram showed a fracture through the greater trochanter, the bone in this region being osteoporotic in appearance,—just enough abnormal to look suspicious.

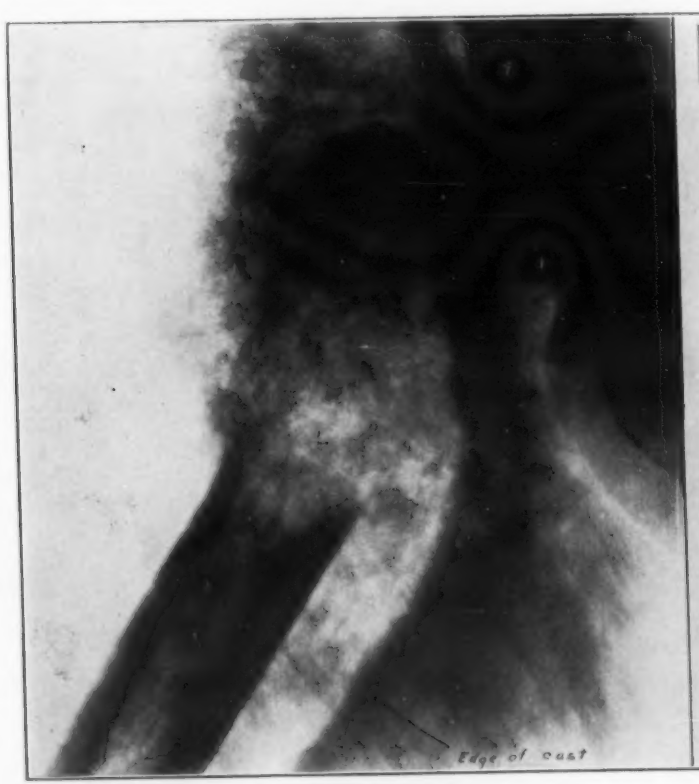


FIG. 7

Case 2. About two months after pathologic fracture.

FIG. 8

Case 2. Gross specimen. About one-eighth of entire tumor. Half size. *C*, center, and line *A-B*, circumference of tumor.

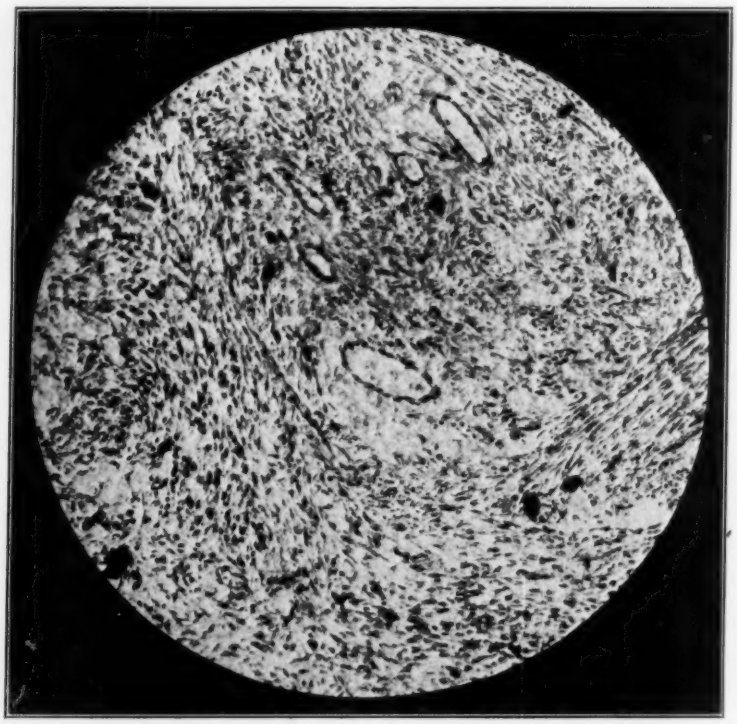


FIG. 9

Case 3. From a dense portion of the sarcoma. Magnification, 100 diameters.

After a few days on extension, a single spica cast was applied holding the fragments in good position. Pain continued.

September 6: Ray showed extensive destruction of the femur in the trochanteric region and also irregular, diffuse proliferation of bone causing general enlargement, without a definite wall demonstrable by roentgenogram (Fig. 7). Diagnosis of malignancy was made and disarticulation of the hip advised but refused.

After removal of the cast, the thigh and the leg began to enlarge with oedema. A diffuse tumor mass gradually developed over the anterior-external aspect of the hip, the skin finally becoming tense and glistening but never breaking. Due to this swelling, the return circulation in the leg was impeded and the entire leg and foot became enormously enlarged by oedema. Pain required from 100 to 200 mg. of morphine daily, gradually increasing.

No evidence of metastasis, either subjective or objective, was ever noted.

Loss of weight and strength and increase of subjective symptoms progressed steadily and death occurred April 4, about nine months after the fracture and the first hint of pathology in the bone as shown by the roentgenogram.

April 5, 1927. Autopsy: Body of an emaciated elderly woman. Left leg shows oedematous swelling, diameter at ankle, seven and five-tenths centimeters; at knee, seventeen centimeters; at upper thigh, twenty-five centimeters. There is a tumor-like growth extending from the rim of the pelvis to the distal end of the thigh. The skin is not broken but veins are enlarged and dilated over the surface. Just beneath the skin is encountered the hard capsule of the tumor about one and five-tenths

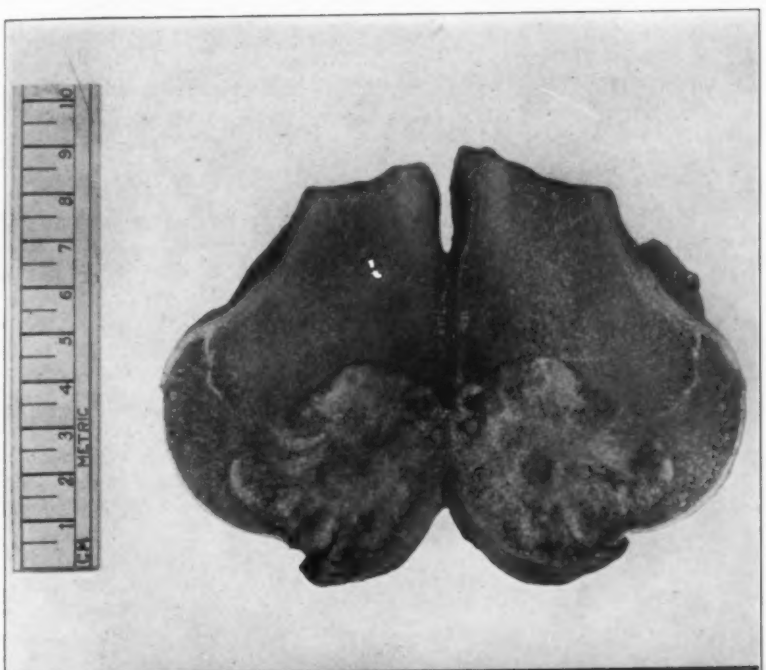


FIG. 11

Case 3. Longitudinal section of resected head of humerus.

FIG. 10

Case 3. About four months after onset of symptoms.

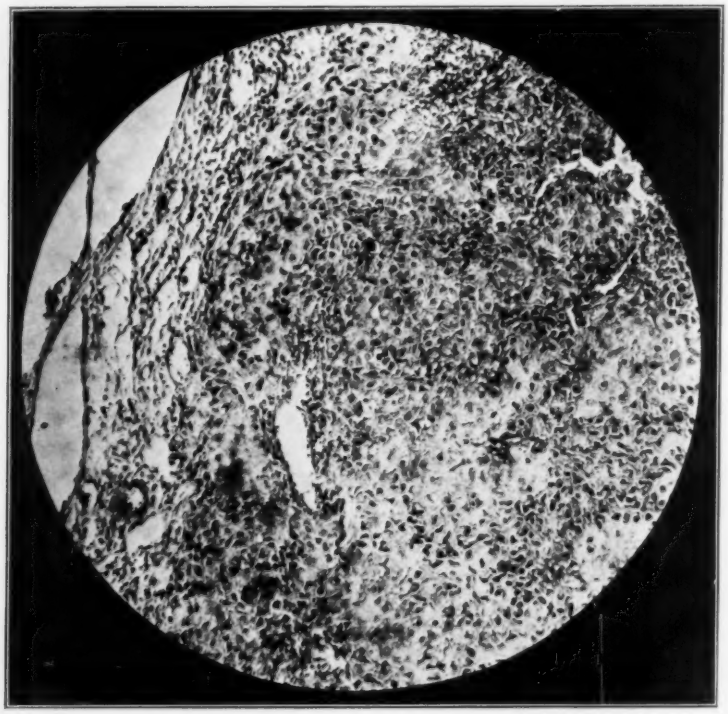


FIG. 12

Case 3. Magnification, 100 diameters.

centimeters in thickness and partly composed of bone. The tumor is oval in shape, its long axis coinciding with the long axis of the femur. It is approximately twenty-five centimeters in diameter and thirty-five centimeters in length. The shaft of the femur goes into its distal end as a stem goes into a plum. On section of the tumor, it contains irregular cavities not definitely walled, filled with reddish-brown, thin fluid and debris of the femoral shaft which is destroyed completely at its proximal fourth. The shaft of the femur ends in the tumor in a rough, irregular fragment. As a whole, the inside of the tumor is soft and spongy, the tissue being friable and formless. The mass has eroded the pelvis and perforated through the acetabulum, involving the inner side of the pelvic bones.

No evidence of growth in any of the abdominal viscera was found. (Permission for complete autopsy was not obtained.) There was obstruction of the bowel caused by pressure of the tumor on the lower sigmoid.

Postmortem diagnosis: Sarcoma of the femur.

Microscopic findings: Sections taken from the tumor mass show a telangiectatic sarcoma. (Sturdivant.)

The clinical course, rapid growth, large size, thin shell filled with fluid and debris, together with the microscopic picture, seem to justify the diagnosis of osteogenetic sarcoma, telangiectatic type.

CASE 3. Male, age twenty, colored.

Family History: Nothing of significance.

Personal History: Influenza; smallpox.

Present Illness: In September, 1926, first noticed stiffness in the right shoulder. Two months before, he had a slight injury to the shoulder of which only an indefinite

history could be obtained. In October, his school gymnasium teacher called his attention to the fact that his right shoulder was larger than his left. In November, he began to have pain and tenderness. This gradually grew worse until at the time of his appearance in the clinic in February, 1927, his right arm was practically disabled by aching pain, weakness, and swelling.

Examination at this time showed a well developed colored boy in good general physical condition. The right shoulder showed diffuse swelling centered over the lateral aspect of the head of the humerus. Slight muscular atrophy. The skin was smooth over the tumor but no dilated veins were present. The tumor mass was firm, rather acutely tender, not circumscribed, uniform in density and immovable. Motion in the shoulder joint was sharply limited, especially in abduction, by pain and muscle spasm.

The enlargement of the shoulder amounted to an increase in lateral diameter of about two centimeters over that of the normal shoulder.

The roentgenogram (Fig. 10), showed both rarefaction and proliferation in and on the greater tuberosity. The roentgenologist's report was osteogenetic sarcoma, possibly giant-cell.

Red blood cells: 5,000,000; white, 11,500 with 77 per cent. neutrophiles.

Urinalysis showed nothing abnormal.

Blood Wassermann, negative.

Roentgenogram of the chest showed no metastases.

Operation was done March 10, 1927. The upper end of the humerus was exposed through an anterior deltoid incision. In the region of the greater tuberosity was an area where the shell of the tumor mass was just beginning to break through into the soft tissues. Otherwise, it was found with intact bony capsule and the soft tissues not invaded. Resection of about eight centimeters of the upper end of the humerus was done, giving the tumor region a wide margin (Fig. 11). The surrounding soft tissues were carefully examined for evidence of the growth and parts that looked suspicious were removed. The fresh bone end and soft tissues were cauterized with an electric cautery.

The diagnosis of the pathologist, Dr. B. F. Sturdivant, was osteogenetic sarcoma.

The wound healed with slight keloid formation but up to the present (ten months later), there is no evidence of local recurrence. It was planned to put in an autogenous bone graft later, to take the place of the resected bone, but the patient thus far has not consented to this procedure.

CONCLUSIONS

These three cases represent types of malignant bone tumors. Cases 1 and 3 differ chiefly in their microscopic appearance. Case 2 differs from the other two in gross structure, being of less dense and more varied consistency. It is a more virulent type, growing to enormous dimensions in eight months but probably not metastasizing, while the tumor in Case 1 did not increase very greatly in size in the same length of time.

A CASE OF COMPRESSION FRACTURE OF THE SPINE TREATED BY TRACTION AND FORCEFUL HYPEREXTENSION

BY J. E. M. THOMSON, M.D., F.A.C.S., LINCOLN, NEB.

From the Orthopaedic Clinic of Drs. Orr and Thomson

The case herein reported is that of a male, age fifty-two, a farmer by occupation who had always enjoyed good health. The accident that caused his disability occurred in his garage when he cranked his truck. He states that, as was his custom, he advanced the accelerator lever, noticing then that the emergency brake was off, but not testing the gear shift which evidently was in gear, for with a single spin of the motor crank the truck was set in motion and he was thrown over backward. In this jackknife position the truck passed over him, dragging him until it came in contact with a tree near by. He could not walk and was carried into the house suffering severe pain in the "middle of his back", pain in the abdomen, and inability to use his legs normally. He could not straighten out or lie on his back and the only comfort he had was lying on the left side with his thighs flexed. Aside from this, his left eye, nose, and back had many cuts and bruises and abrasions.

After the administration of opiates to allay his suffering, he was removed to the hospital about one hundred and seventy miles distant by auto and train. He suffered severe pain in spite of sedatives. He was pale and livid and a cold perspiration covered the upper part of his body. The respiration and pulse were slow and he was suffering from severe shock.

Upon examination of his back there was found a marked kyphosis in the upper lumbar region and an extensive contusion of the overlying soft tissue. The abdomen was distended and very tense. The right leg was partially paralyzed, while the left could be moved voluntarily but only with pain referred to the abdomen and back. Passive movement of the right leg caused pain. The knee jerk was absent and sensation was disturbed.

X-ray revealed a crushing fracture of the second lumbar vertebra with marked compression anteriorly, and a slight lateral and rotary displacement of the spinal column originating at the site of injury. Strong traction was immediately applied to both legs with the foot of the bed elevated. Hyperextension under the small of the back by means of pads was instituted. In a few hours, without further sedatives, the patient was comfortable. In twenty-four hours function began to return to the right leg. The knee jerks had returned by the second day. By the morning of the third day the back was in extreme hyperextension while under traction; as the pads had been gradually thickened the kyphosis had entirely disappeared. The abdomen was soft and flat and his general condition much improved. He was removed to the plaster room, and while lying on his face between two tables traction was applied to his arms and legs. In addition to the gravity weight of the trunk to establish hyperextension in the region of the injury, a muslin sling was swung across the back and a ten-pound sand bag swung below to forcibly bring pressure to the lumbar region. In this position a plaster body cast was applied with result as shown in the x-ray.

In Figures 1 and 2 we find an anterior crushing of the body of the third lumbar vertebra with extreme kyphosis, and a lateral compression, deviation, and rotation. In Figure 3, which was taken after the cast was applied just three days following the injury, there is complete restoration of the vertebral body contour (Only lateral x-rays were taken at that time.), and a complete correction of the kyphosis and structural deformity.

One month later a Hibbs fusion operation was performed and the patient is making an uneventful convalescence with normal function of both legs.

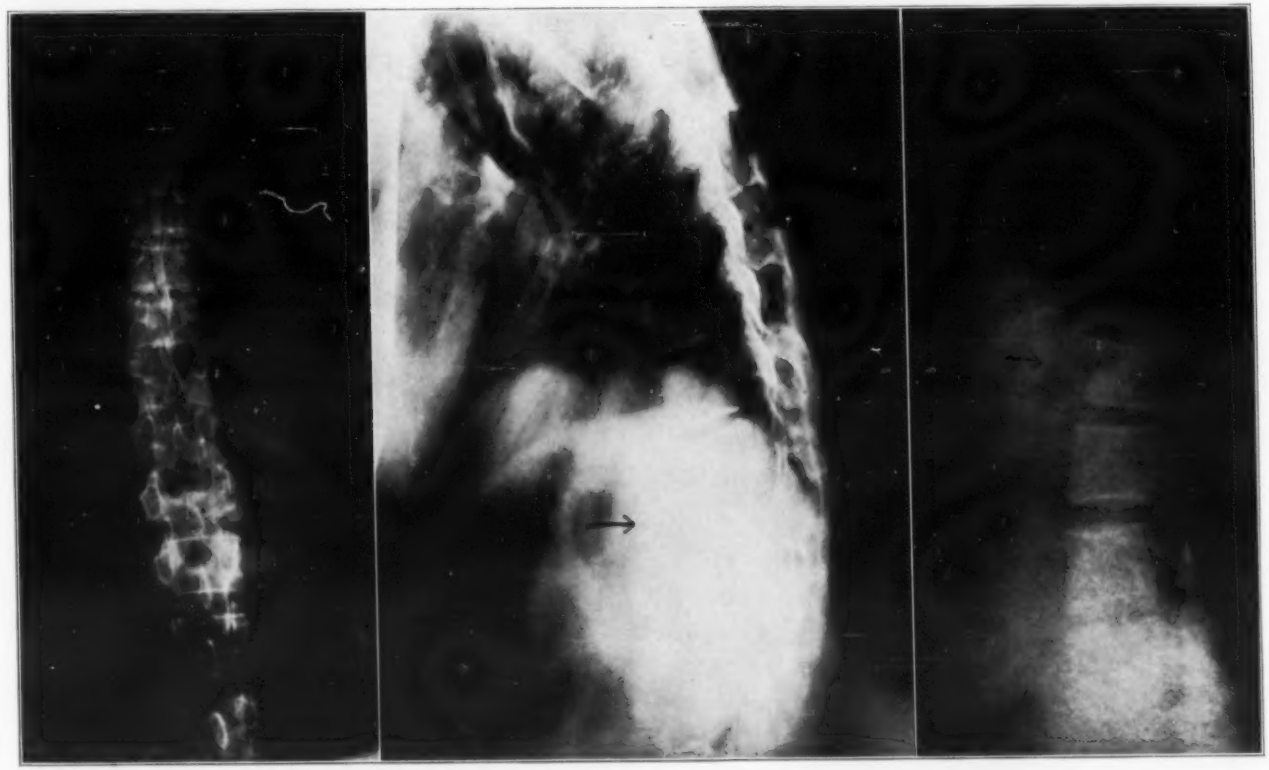


FIG. 1

Anteroposterior roentgenogram showing angulation and deformity at junction of first and second lumbar vertebrae.

FIG. 2

Lateral roentgenogram showing crushing and contusion of body of second lumbar and injury to body of first lumbar vertebra with marked kyphosis of the spine.

FIG. 3

Lateral roentgenogram showing complete restoration of fragments of crushed second lumbar vertebra. The spine is now in hyperextension.

In reviewing a relatively large series of vertebral injuries that have come under the observation of the author, at least from an x-ray standpoint, this case appears to have rather unusual restoration of bony or structural defect, which was accomplished by strong traction and rather forced hyperextension. These particular methods, used as described in the above case, were not ordinarily used together with such vigor as here described, but the result in this particular case with extreme deformity and injury to the vertebral substance and nerve structures seems to justify its further trial. Is it not possible by the application of the principles of traction to the extremities and cross pull or traction to obtain hyperextension, that in certain of the crushing vertebral injuries, particularly in the more flexible lumbar region, we might bring the fragmented structures back to a more normal contour and allow the callus to fill out the defect, leaving a more normal condition?

The question has been asked, Why the fusion operation? It has been the author's experience with severe crushing injuries of the spine that this procedure hastens the convalescence and ultimate rehabilitation of the patient. And in this particular case, with such splendid return of normal and anatomical appearance, the additional bracing of such an extensively damaged area seemed essential.

OSTEOGENESIS IMPERFECTA WITH MULTIPLE FRACTURES AT BIRTH: AN INVESTIGATION WITH SPECIAL REFERENCE TO HEREDITY AND BLUE SCLERA

Case Report

BY BARNEY J. HEIN, M.D., F.A.C.S., TOLEDO, OHIO

This case is reported in order to add one more to this very interesting group. Besides considering the nine distinct fractures, an investigation was made with special reference to the relationship of heredity and blue sclera to fragile bones.

CASE REPORT

L. M., girl, age twenty-four hours; brought to Maternity and Children's Hospital December 1, 1923, on account of deformities and abnormal points of mobility over the long bones of all four extremities.

Physical examination. A fairly nourished premature female (eight months), weighing three pounds, twelve ounces.

Measurements of body and extremities: from soles to crown fifteen and one-half inches; from umbilicus to soles nine and one-fourth inches; from umbilicus to groin six and one-half inches. Girth at umbilicus eleven and one-quarter inches; at nipples eleven and five-eighths inches. Head: circumference of occiput-bregmatis thirteen inches; greatest anterior posterior diameter three and three-quarters inches; biparietal four and three-eighths inches. Entire occiput flattened and anterior fontanelle approximately two inches in the sagittal and transverse diameters. All sutures open. Squamous portion of the temporal bones soft. Other cranial bones had hard edges and some were hard throughout. Posterior fontanelle about three-quarters inch, difficult to measure accurately.

Eyes: Blue sclera—otherwise normal.

Nose: Snuffles.

Heart, lungs and abdomen normal. The examination of the extremities revealed abnormal mobility, deformity, and crepitus over both femora, both humeri, and the right forearm.

X-ray examination: "This case, when examined, showed nine distinct fractures, namely: the right tibia and fibula, the right and left femora, the right radius and ulna, the right and left humeri, and the right clavicle. The bones of the skeleton, especially the long bones, showed marked atrophy and are evidently very soft. This is shown by the character of the plate and also by the distortion of some of the thoracic vertebrae, especially evident in the fifth, which is wedge-shaped. These changes probably were caused by pressure. There does not appear to be present any of the characteristic changes of lues or rickets about the joints or epiphysis, from which I think we can rule out these diseases". (Signed), *R. Deming, M.D.*

Following this examination an investigation was made as to what degree of trauma was exerted at the time of delivery, and what part this trauma might have played in the production of the fractures. A detailed history was secured from, first, her attending physician, second, her attending nurse, and third, the mother herself. We found the mother to be a multipara with a normal pelvis, having had two previous normal births. The delivery had been spontaneous, lasting only four hours. We therefore concluded

that the multiple fractures were the result of an abnormal fragility of the osseous structures and not due to any unusual birth trauma.

Diagnosis: Osteogenesis imperfecta.

Treatment: The fractures were treated in extension, the left humerus with the elbow flexed, as the best approximation of fragments could be obtained in this manner. The right arm was extended at the elbow. The legs were placed in abduction with traction and suspension as indicated in Figure 1. Sufficient traction was applied to the limbs to raise the buttocks slightly off the bed. This position facilitated nursing. Traction on all four extremities was made by adhesive plaster after the skin had been properly prepared. This was inspected frequently. The treatment was continued for eighteen days, and then all apparatus was removed. Following the removal of the apparatus it was noticed that the thighs would not approximate normally. This gradually improved and examination at this time revealed what we considered good union.

Subsequent x-ray: December 19, 1923. "The fractures observed on previous examination united with evidence of callus in all instances, with exuberent callus in right tibia and fibula". (Signed), *R. Deming, M.D.*

It is an interesting fact that bony repair was remarkably rapid.

Progress: Coincidental with the treatment of the fractures was that of feeding. The pediatric supervision was under the direction of Dr. Stanley Giffen of Toledo. The increase of weight was very slow. One month following her admission her weight was four pounds, seven ounces; at two months her weight was five pounds and three ounces; at three months, five pounds and five ounces; at four months, five pounds and eleven ounces. The highest weight obtained in the case was at four and one-half months when on April 16, 1924, it reached six pounds and an ounce.

During the course of this patient's stay in the hospital she developed a furunculosis, which did not react well to any treatment. It never entirely healed. On April 22, 1924, the patient developed a pneumonia with a subsequent fever of 106 degrees accompanied by cyanosis. There was a slight dullness over the upper right back. Some fine râles

FIG. 1

Showing patient under treatment. Suspension of both legs and extension of both arms.

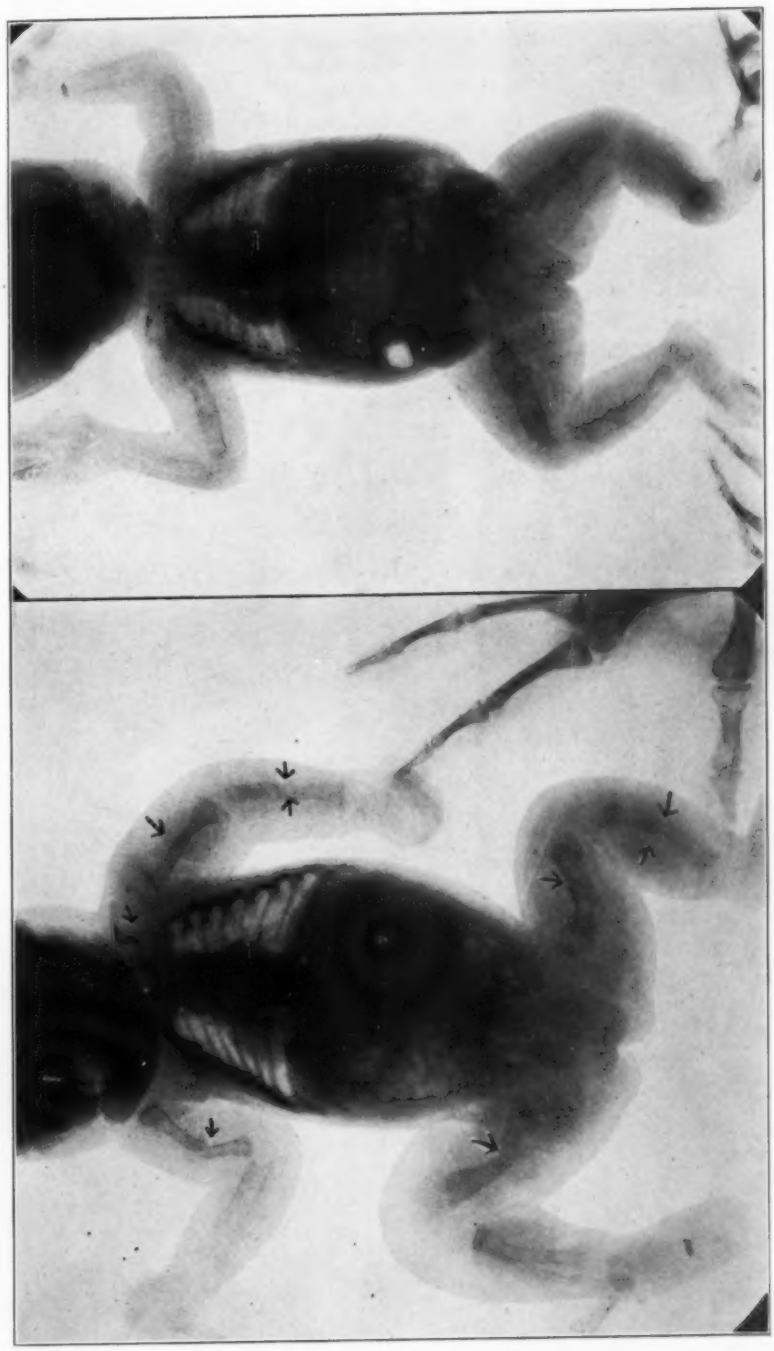


FIG. 2
X-ray taken on admission showing nine long bones fractured.

FIG. 3
Subsequent x-ray showing healing of fractures after three weeks.

were heard at the right apex. This condition gradually grew worse and on April 24, 1924, she died.

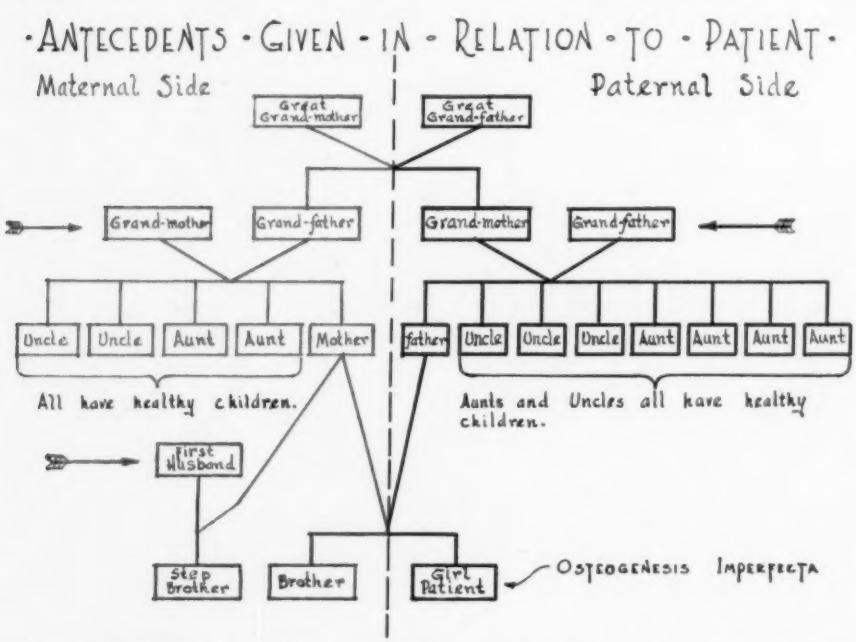
Postmortem: The essential points were as follows: General appearance emaciated. Head was markedly flattened posteriorly; all cranial bones fragmented. Biparietal diameter of head six inches; anteroposterior diameter four and one-half inches. The lambdoidal, temporal, sagittal, and frontal sutures were not united. There was present considerable fine fluid beneath the cranial bones superficial to the brain. The cranium was of egg-shell consistency. It is interesting here to note that in holding the calvarium before a light the various lines of previous fractures could be seen. These fractures probably occurred at different times in the ordinary acts of turning and placing the patient in bed.

Chest: The upper and lower lobes of the right lung were consolidated; consolidation was also present in lower lobe and apex of upper lobe of left lung. Thymus extended down about an inch below the thoracic notch; weight three and one-half grains. Foramen ovale of heart was pouched but not patent. Blood vessels normal.

Abdominal organs: All normal except spleen which was smaller than average. Weight of suprarenal one and one-quarter grains.

Extremities: Left leg held in everted position, slight bowing of left femur outward. All fractures healed by osseous union except the left humerus where the union was fibrous.

Investigation of antecedents: Owing to the unusual opportunity to study this family, a complete investigation was made to determine what influence heredity might play in this rather unusual condition. The study was made with reference to fragility of the bones and to blue sclera. Twenty-three relatives were investigated (See chart.). In no instance was there



This diagram was made with two objects in view: First, to show the number investigated in the family; Second, to show the family relationship between the mother and father of the patient, they being first cousins.

present a history of fragile bones or blue sclera. The examination did reveal that there was an intermarriage, that is, mother and father were first cousins.

Conclusion: The case further emphasizes two observations, namely: that fractures in cases of osteogenesis imperfecta unite readily, and that there has been no relationship established between heredity on the one hand, and fragilitas ossium and blue sclera on the other.

THE RANGE OF ACTIVE MOTION AT THE HIP JOINT OF MEN

BY JACK BEALS MOORE, A.B. AND JOHN ORREN VAUGHN, A.B.,
STANFORD UNIVERSITY, CALIFORNIA

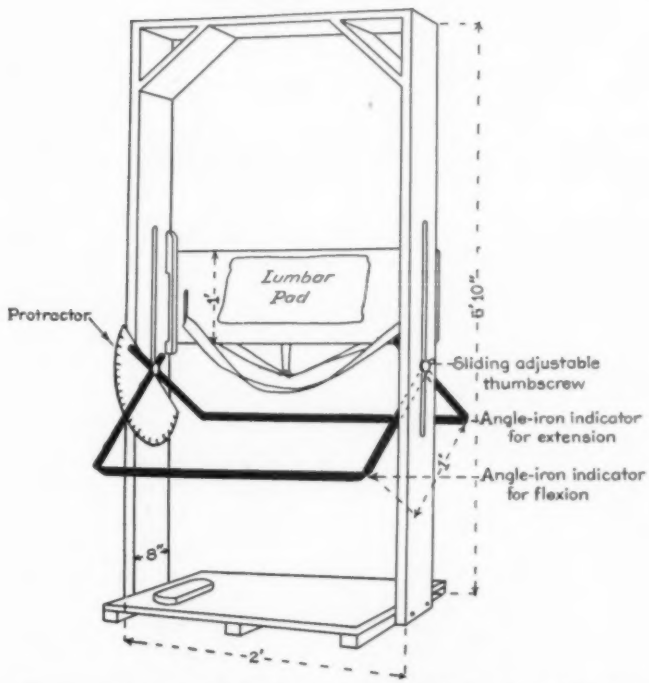
From The Department of Anatomy of Stanford University

Measurements were made on one hundred healthy men to ascertain the amplitude of flexion and extension at the hip joint. The majority of persons were university students in the third decade, with ages from twenty to forty-three years. Of the one hundred individuals, eighty-five were in the third decade of life and the remainder were distributed about equally in the second and fourth decades. The movements of those in these two decades were within five degrees of the average motion for the entire group, thus suggesting that the range of motion is unrelated to age, as far as the second to fifth decades are concerned, excepting that extension on both sides shows a tendency to decrease with age.

The apparatus used for these determinations is shown in Figure 1. It was suggested by Dr. Meyer and consisted of two heavy wooden uprights six feet, ten inches high, separated by a distance of two feet and provided with an adjustable sliding back-rest, the whole being mounted and adequately braced, upon a solid wooden base. Vertical slots in the uprights carried two U-shaped angle-irons which could be adjusted to the level of the trochanters. Readings in degrees were made from circular protractors centered at the axis of rotation. A two-inch, movable, wooden block engaged a strip on the baseboard in such a manner that the supporting heel and the trochanters of the individual were in the same vertical plane. To secure fixation of the pelvis against the back-rest, fitted to the lumbar region, a broad canvas strap was passed below each anterior, superior spine of the ilium, thereby firmly fitting the lumbar curvature to the pad on the back-rest. The whole was adjustable anteroposteriorly so as to bring the axis of rotation through the center of the acetabula.

According to Bryce in Quain's Anatomy[1], the transverse axis, about which flexion and extension of the thigh occurs, cuts the highest point of the trochanter major of the femur, at the mid-point of a line drawn on the surface between the anterior-superior spine of the ilium and the ischial tuberosity, of a living person. Hence, the tip of the trochanter was located by palpation, and the protractor centered at this level. By strapping the pelvis to the back-rest, the acetabula were immobilized. Free motion was obtained for the extremity to be measured by placing a two-inch block under the opposite foot. Flexion of the free thigh carried the anterior, angle-iron indicator forward and upward in an arc whose center of rotation coincided approximately with that of the moving limb. Sufficient friction between the indicator and the sides of the stand was

FIGURE 1.



Apparatus for measuring the amount of motion at the hip joint.

permitted to avoid throw and to hold it at the highest point of excursion. The total range of flexion in degrees was then read from the protractor. The range of extension of the same limb was determined by the same method, using a posterior angle-iron indicator. By placing the block under the opposite foot, readings for the opposite side were taken by a similar procedure. Two preliminary trials in each movement were made, to accustom and instruct the individual. Then four successive readings for each movement were taken by one observer and recorded by the other. The latter, by careful observation, tried to guard against such infractions of technique as abduction and external rotation during motion, or other movements which might have altered the axis of rotation. The average of the four readings was recorded, as the range of motion, and the age, height and weight, and past history were recorded whenever pertinent.

The individuals were students in the Stanford Medical School, and nearly without exception wore loose-fitting corduroy trousers at the time observations were made. The fact that they were medical students insured sympathetic and intelligent cooperation with a minimum of instruction, and the readings from successive trials upon a given series indicate a low percentage of error. The latter probably was less than five per cent., and this was minimized by averaging four readings for each movement. The

TABLE OF AVERAGE MEASUREMENTS*

No.	Age	Height		Weight	Right		Left	
		feet	*inches*	*pounds*	Flex. *degrees*	Ext. *degrees*	Flex. *degrees*	Ext. *degrees*
1	23	5	8	160	107.6	34.4	110.9	29.8
2	22	5	6½	137	108.1	33.6	121.3	33.3
3	29	6		176	110.3	27.2	116.2	26.3
4	22	5	10¾	160	106.2	41.9	115.4	49.3
5	28	5	9	178	116.6	38.7	117.7	35.8
6	23	5	9½	150	115.2	34.6	110.9	35.7
7	27	5	9½	170	116.9	28.8	120.1	30.4
8	24	5	10½	180	117.3	25.0	122.9	23.1
9	28	6	1½	175	109.8	25.0	109.0	17.8
10	24	5	6½	124	115.3	24.1	114.8	16.1
11	22	5	9½	135	106.4	17.4	119.0	21.1
12	39	5	7½	136	112.7	28.8	127.0	26.9
13	24	5	8½	145	129.3	21.9	127.5	26.6
14	32	5	8¼	210	105.9	31.8	105.5	29.5
15	22	6		208	108.8	36.9	116.0	28.5
16	30	5	9	138	121.1	34.1	120.9	31.5
17	30	5	4½	168	95.0	28.5	97.9	30.3
18	30	5	10½	178	105.0	33.0	114.4	27.6
19	22	5	10	160	104.4	24.4	101.8	26.6
20	22	5	11¾	170	116.6	26.2	110.0	22.3
21	22	5	8	145	121.8	32.1	124.6	30.8
22	20	6		203	109.3	36.3	107.1	38.5
23	23	5	5	130	109.6	31.3	108.6	29.4
24	23	5	2½	130	108.4	36.4	107.1	35.8
25	21	5	11	145	118.7	28.6	121.8	26.7
26	21	5	10½	135	126.9	35.6	133.1	25.5
27	21	5	11	150	112.4	28.2	111.2	26.4
28	25	5	10½	154	121.6	28.3	125.8	29.7
29	24	6		158	115.6		117.3	
30	20	5	8½	165	113.1	35.3	110.0	40.1
31	25	5	10½	170	120.3	36.0	120.3	31.8
32	37½	5	4	165	114.8	35.6	115.0	33.6
33	24	5	7	115	112.7	32.8	107.8	31.6
34	29	5	10½	160	129.1	34.8	128.8	37.0
35	23	5	11	150	119.9	42.1	119.1	34.3
36	24	6		140	121.3	29.4	118.3	25.6
37	23	6	2½	142	121.8	50.9	123.6	45.1
38	22	5	8	135	108.7	36.5	109.9	39.9
39	22	6		160	112.5	29.9	112.4	29.9
40	23	6	1½	178	113.4	36.4	112.1	35.8
41	23	5	10	150	109.1	31.3	115.1	25.7
42	29	5	11	152	114.5	34.0	117.8	30.3
43	21	5	8	140	110.9	30.0	119.4	30.6
44	21	6		154	125.1	30.0	126.3	30.1
45	27	5	8	148	114.2	31.7	122.6	31.6
46	22	6		155	122.6	36.1	117.8	36.2
47	22	5	8¼	152	122.6	35.4	117.7	35.2
48	22	5	5½	130	112.9	25.8	113.4	25.2
49	26	5	6	135	116.2	35.1	117.4	32.8
50	22	5	7	165	98.8	33.3	101.5	31.4

TABLE OF AVERAGE MEASUREMENTS*

No.	Age	Height		Weight	Right		Left	
		feet	*inches*	*pounds*	Flex. *degrees*	Ext. *degrees*	Flex. *degrees*	Ext. *degrees*
51	22	6		165	111.6	31.5	119.1	34.9
52	23	5	9	162	98.1	31.1	105.9	31.8
53	22	6		170	118.3	25.4	121.8	24.3
54	22	5	9	145	113.8	25.8	116.9	26.9
55	24	5	8½	145	126.2	46.5	127.9	47.8
56	22	5	11	158	113.8	24.5	112.1	27.4
57	20	6		175	113.0	25.3	120.8	25.4
58	27	5	10½	150	114.8	28.5	112.1	23.5
59	28	5	9	150	112.6	43.0	120.1	38.9
60	22	5	8	150	113.0	42.5	116.8	35.3
61	20	5	7	145	123.5	42.3	122.1	37.0
62	20	5	8½	145	109.4	31.1	109.0	33.9
63	21	5	6½	145	115.6	34.5	122.3	34.5
64	26	5	9	165	109.5	36.4	108.2	32.5
65	24	5	10½	168	114.0	32.6	109.5	35.4
66	21	5	9½	152	108.1	31.1	109.8	30.0
67	21	5	8	135	115.8	40.0	120.4	39.6
68	27	5	6½	138	116.3	35.6	119.0	29.4
69	22	5	6	131	116.5	27.6	123.9	29.9
70	21	4	11	120	95.5	25.4	100.0	28.1
71	21	6		170	108.0	33.9	108.1	28.9
72	22	5	11	156	110.6	25.9	111.0	30.9
73	20	5	11	165	96.0	31.3	100.5	25.4
74	20	5	10	154	106.4	24.3	107.8	24.6
75	24	5	6	140	103.3	27.9	110.9	28.4
76	21	5	9½	160	108.5	30.5	115.9	29.5
77	31	5	11½	158	114.1	27.0	109.6	27.5
78	22	6		158	110.9	24.6	112.6	22.6
79	21	6		141	106.1	34.1	109.3	35.4
80	23	5	5½	148	110.4	40.8	107.5	39.9
81	22	6	1	160	110.8	37.8	108.4	33.9
82	23	5	8	166	117.1	42.1	118.9	38.0
83	21	6		160	113.9	37.8	117.8	33.9
84	21	5	11½	178	123.8	30.1	120.6	30.6
85	21	5	9	167	109.6	29.4	115.6	23.4
86	23	5	6½	140	100.5	39.9	105.0	45.1
87	21	6	1½	171	118.6	36.9	126.1	37.1
88	27	5	11	170	108.1	22.3	119.4	21.9
89	21	5	8	150	108.6	32.9	113.5	33.9
90	24	6		155	129.9	41.6	120.5	36.3
91	21	5	8	155	114.8	32.1	115.6	34.8
92	24	5	9½	165	119.9	34.8	124.8	35.1
93	27	5	10½	175	100.5	32.0	102.3	32.0
94	21	6		165	106.8	23.8	113.8	24.6
95	22	5	2	127	109.5	36.4	117.1	30.0
96	24	5	2½	123	119.5	39.5	118.8	33.6
97	20	5	6	145	106.4	44.8	108.3	44.1
98	43	5	5	125	117.8	30.9	121.6	31.3
99	25	5	6½	140	119.4	29.4	118.8	29.6
100	24	5	6½	175	117.6	33.3	117.4	32.0

*In the construction of all graphs the English were converted into metric units.

values obtained for each successive reading seldom differed more than five degrees, although only six per cent. of the readings in flexion and extension for right and left, were practically alike. In ten per cent. of the readings a tendency to an increase in the range of movement with practice was present. This amounted to from two to five degrees. One per cent. on the contrary, showed a fatigue effect by a decrease in movement of from two to five degrees during successive trials. There was no evidence that uncertainty in movement was greater on one side than on the other.

The compilation of the data appended gave the following averages:

AVERAGE RANGES FOR THE ENTIRE GROUP

	Flexion	*Extension*	*Total Range*
Right	113.2°	32.5°	145.7°
Left	115.3°	31.3°	146.6°

Maximum, Minimum and Greatest Total Ranges Not in the Same Individual

MAXIMUM RANGES

	Flexion	*Extension*	*Greatest Total Range of Motion*
Right	129.8°	46.5°	172.6°
Left	133.1°	49.2°	175.6°

MINIMUM RANGES

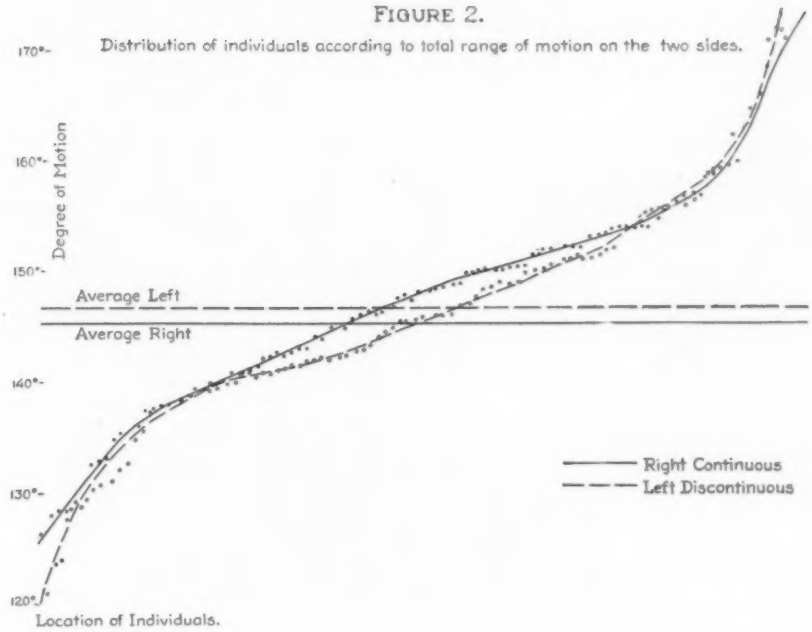
	Flexion	*Extension*	*Smallest Total Range of Motion*
Right	95.0°	17.3°	120.8°
Left	97.9°	16.1°	125.8°

The smallest range of motion in any one individual was 121 degrees and the largest 175 degrees. The distribution of individual total ranges on either side of the average was approximately the same. This is shown in graphic form in Figure 2. The graph in Figure 3 shows the distribution in range of motion of the two extremities in ascending steps of five degrees. It corresponds to the graph in Figure 2, for the peak of the curve for the left extremity is at a figure about ten degrees above the average.

The total ranges of movement of ninety-nine individuals were classed in two groups, those measuring above the average (145.7° right; 146.6° left), being considered as having an increased range of motion, and those measuring below these figures as having restricted motion. By this method, forty-nine individuals were found to have an increased range on the right, and fifty a restricted range. Similarly, fifty-three cases had extended ranges on the left, and forty-six had restricted movement.

Analysis of the average flexion and extension of these individuals showed that the increase or decrease in the range of motion amounted to approximately four per cent. of the average range in flexion and ten per cent. of that in extension, on both sides. In other words, departures from the average total range of motion are somewhat more marked in extension.

FIGURE 2.



The explanation for this finding may lie in the fact that the movement of flexion is developed to nearly its full extent, in squatting and other similar movements, while extension seldom reaches a maximum.

When an attempt is made to correlate the weight of the individual with his total range of movement, as shown in the graph in Figure 4, no definite relationship is found to exist, except that heavier individuals (68–90 kg.) have a slightly less range of motion, probably due to limitation by the soft parts.

When stature is similarly considered, as represented in the graph in Figure 5, the only marked deviations from the average lie in the shortest and tallest groups (150 and 189 cm. respectively). Although these deviations are very great, the fact that there was only one person in each of these groups does not justify any generalization.

All persons having a total range of five degrees or more above the average range, on the right or the left side, were placed in a group and considered as right- or left- "legged". Twenty-two were found to be left-legged, and twelve right-legged to the extent of five to fifteen degrees. As shown in Figures 6 and 7 the deviation from the average range is about equally divided between the movements of flexion and extension in right-legged men; four per cent. of them have a greater range in flexion, and four and four-tenths per cent. in extension. On the other hand, in the left-legged group the deviation from the average occurred ten times more frequently in flexion than in extension, or in two per cent. in flexion, and only in two-tenths per cent. in extension. Through personal inquiry no

FIGURE 3.

Distribution of cases according to total range of motion on the two sides in groups of five degrees.

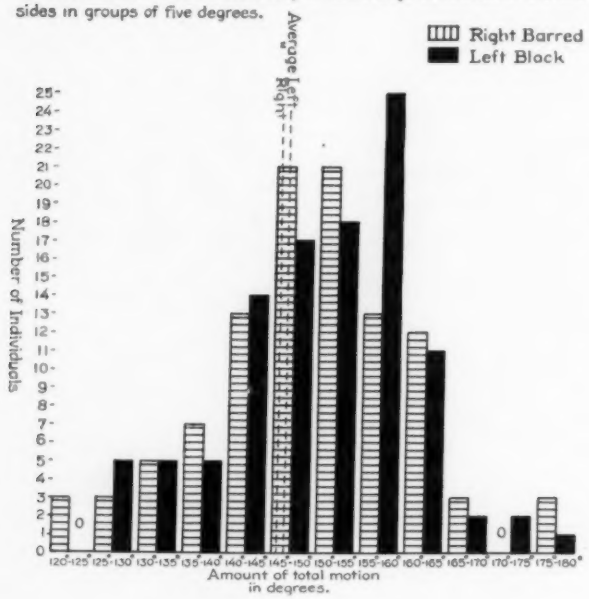


FIGURE 4.

To show the relation of weight to range of motion. Weight in kilograms on the abscissa and total motion in degrees on the ordinate. Solid line represents the right, and the broken line, the left side. 100 cases.

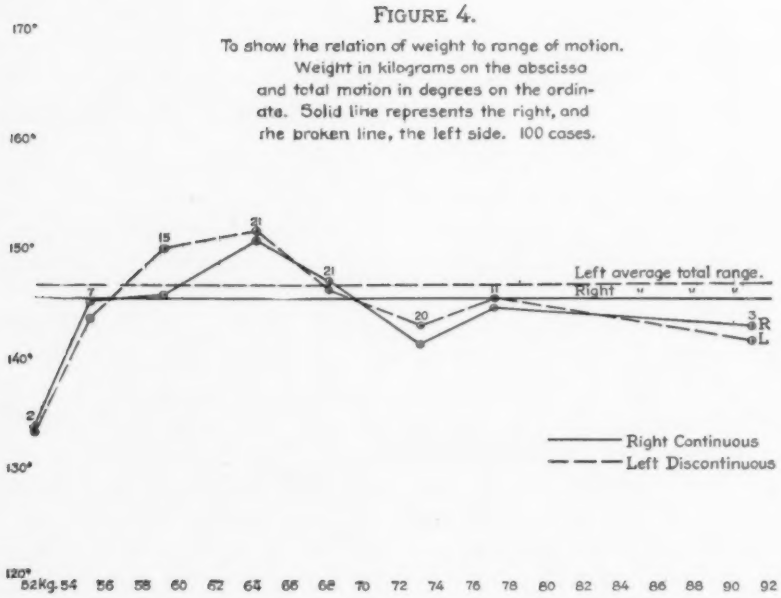
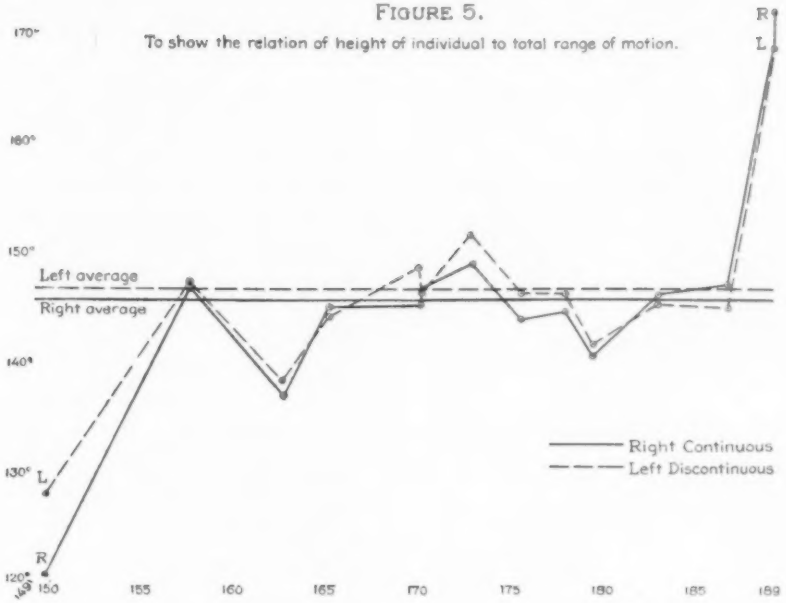


FIGURE 5.

To show the relation of height of individual to total range of motion.



relationship was detected between a left-handed and a left-legged tendency, but right-handedness was correlated with left-leggedness, as is well known from other data.

The relationship between the range of flexion and extension was not constant, for the ratio of flexion to extension was a decreasing one as the more extended ranges of total motion were reached; that is, an increase in the total range of movement was due largely to an increase in extension.

The average motion in these students and the total range is larger than that obtained by Gilliland[4], as shown in the accompanying table.

	Gilliland	*Moore-Vaughn*
Average	129°	145°
Range	85°–162°	125°–175°

The average amount of motion obtained by passive motion on ligamentous preparations by Weber and Weber was 139°, according to Strasser[2], but such preparations hardly form reliable material for the determination of ranges in the living. However, it is surprising that the results obtained by Weber and Weber are so nearly the same as the authors'. This suggests that fixation of the ligaments by preservatives results in about the same limitation of motion as the presence of the soft parts.

SUMMARY

1. The total range of motion, in flexion and extension, at the hip joint in normal young adult males is approximately 146 degrees on both sides, the average flexion being 114 degrees and the average extension 32 degrees.

FIGURE 6.

To show the relation of flexion & extension in right & left legged men.

FIGURE 7.

Distribution of flexion & extension in left legged men.

2. The range of motion in the individual lies between 121 degrees and 175 degrees.

3. Deviations from the average range are slightly more marked in extension.

4. The flexion: extension ratio decreases as the total range increases.

5. The range of motion shows no relation to height or weight except when the extremes are reached.

6. No marked tendency to right- or left- "leggedness" is demonstrable from the range of motion that exists.

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LOOSE BODIES ORIGINATING FROM THE PATELLA*

BY RODNEY F. ATSATT, M.D., SANTA BARBARA, CALIF.

A loose body in the knee joint is a fairly common lesion, but, as is well known, the usual site of origin is on the internal condyle of the femur, with the patella and tibial head as infrequent sources.

The author presents the following case, which is unmistakably one of traumatic origin.

CASE HISTORY

White, male, age twenty-four, occupation—egg handler.

Complaint: Pain and stiffness in right knee.

Present Illness: Previous to accident the knee had been perfectly normal. Thirteen days before being seen, while playing baseball, the patient was struck directly on the knee cap by the head of a runner who was making a dive for the base which the patient was guarding.

There was some immediate pain in the knee lasting for about half an hour, but patient was able to continue playing. Thereafter there was a dull ache in the knee noticed only on walking. There was swelling of the knee. On the lateral aspect there was noticed an area of tenderness over the tendon of the biceps.

On the tenth day after injury patient felt a sudden sharp pain, moderate in character, and the knee locked momentarily. While rubbing his knee after it had unlocked, the patient felt for the first time a freely moveable lump on the mesial aspect which was neither tender nor painful.

Examination: Patient presented a swollen knee, some periarticular thickening, but mostly due to effusion. The normal ranges of motion were present. There was a non-tender freely moveable body in the internal lateral pouch. There was a slight tenderness in the biceps tendon at the level of the joint.

Roentgenology: An irregular defect was noted on the inferior articular surface of the patella. No loose body was visualized.

Course: Operation was advised but refused. Five days following the office examination, patient had sudden severe pain in the knee accompanied by locking, which was relieved only after considerable manipulation on the part of the patient. He noticed at this time that the loose body had disappeared and that it reappeared after the knee had unlocked. Two days later the patient returned with a request for operative relief, and so twenty days after injury the loose fragment was removed.

Convalescence was uneventful and with the use of liberal physiotherapy the patient was back at work as a truck driver in one month.

Operation: The loose body could not be located before operation, so a median parapatellar incision twelve centimeters in length was made. Patella was retracted laterally and median aspect of knee explored, using long grasping forceps and external manual manipulation. External pouch similarly explored and loose body obtained. Wound closed in usual manner.

Pathology: The loose body, measuring fourteen by eight by four millimeters, was a roughly rectangular concavo-convex piece of cartilage with sharp square edges, covered on the concave side with a layer of synovial membrane. This membrane projected be-

*Read before the Southern California Medical Society.

yond the limits of the cartilage along one side as though there had been a V-shaped tear in the adjoining tissue. The convex side was roughened, but macroscopically contained no bone fragments. Unfortunately the piece of tissue was lost in the laboratory, so no microscopic study was possible.

The defect in the patella was located in the mesial articular facet, near the distal border. The edges of this defect were rounded and the base was "hillocky" in appearance, as though the regeneration of the cartilage were proceeding unevenly. The defect was about one-third filled.

The synovial membrane of the knee was only slightly injected and not appreciably thickened. There was a slightly increased amount of fluid, but on the whole the knee joint was in good condition.

DISCUSSION

The history and physical findings may be interpreted as follows: At the time of the injury a portion of the articular cartilage on the mesial aspect of the patella was loosened. It remained in place however and the knee gave only symptoms of a traumatic synovitis until about the tenth day after injury, when for some reason it became displaced into the joint and caused slight locking of the knee. Immediately after manipulation of the knee there was noticed a freely moveable lump in the mesial pouch. Eight days later the free body again entered the joint proper and caused locking of the knee, reappearing in the mesial pouch following manipulation. With such a history, operative removal of the loose body was clearly indicated. The progress in the above case corresponds in action, at least, to the process involved in osteochondritis dissecans, but with such a clear history of trauma, it is hardly necessary to look for any unusual morbid condition to explain the pathology.

The etiology concerned in the process of formation of these bodies is not always clear. Following the application of the term "osteochondritis dissecans" to this type of lesion by König[1], the theory of a dissecting necrosis of bone and cartilage was generally accepted. In recent years careful pathological study of the detached or semidetached bodies has often shown either clean fractured surfaces or surfaces in which repair rather than necrosis was taking place. It is now felt by many that trauma, either directly or indirectly applied, is the most likely cause for the lesion.

A loose body with origin from the patella is a relatively rare condition. A review of the recent literature reveals only seven reported cases.

Moschcowitz[2] presents a case of loose body arising from the patella. There was no history of injury. The small cartilaginous mass was still attached at its lower border to the patella.

Phemister[3] states that the patella is occasionally the source of free bodies and cites a case with such an origin. Careful examination gave no clue as to the process causing separation of the body. He seems to have felt that it may have been either fracture or absorption, but probably was due to an incomplete fracture.

Timbrell Fisher[4], gives a case taken from the Museum of the Royal College of Surgeons with a history of direct trauma by which a wedge-shaped piece of bone and cartilage was fractured from the lower articular

surface of the patella. The mass was still attached, at an angle, by a few fibers of the ligamentum patellae. A second case is presented in which there was a transverse fracture of the patella with separation of a portion of the bone and articular cartilage to form a loose body.

Osgood and Surls[5] mention the patella as a source of loose bodies, but present no case.

Kappis[6] feels that loose bodies arising from the patella are due to force applied as a tangential strain. He states that such bodies are rare but cites a case of this type.

Kleinberg[7] reports a case in which there were three loose bodies with origin from the patella. The history gives a definitely traumatic basis for the separation of the fragments and Kleinberg feels that they were probably shaved or scraped off the patella by a direct blow when the knee was semiflexed.

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"ARTRORISE" OF THE FOOT*

BY G. NOVÉ-JOSSERAND, M.D., LYON, FRANCE

The idea of limiting the motions of the tibiotarsal articulation by a bone prop to prevent deformity of the paralytic foot, belongs to Toupet, who in 1919 performed an astragaloid arthrodesis by means of a graft, transfixing the astragalus and the calcaneus, and allowing the posterior extremity to project behind as a prop against the tibia, in order to prevent the drop of the foot. Two years afterwards, Putti introduced an anterior prop, in order to prevent the calcaneus, and to aid in walking without apparatus in paralysis of the femoral quadriceps. He proposed for this operation the very acceptable name of "Artrorise". In 1923, Campbell of Memphis published the method of a new technique, of a posterior prop, and in 1925 the author presented another, at the French Orthopaedic Congress. The results of these operations are beginning to be known through the work of Putti, Calendra, Camera and Delitala; and the time has now come to study this question and to see what may be the indications for this operation.

The posterior artrorise has been performed following three different procedures. The original procedure of Toupet does not seem to have found very favorable acceptance, for it is known that the subastragaloid arthrodesis, made by the means of graft transfixing the bone, is precarious. Ombredanne has seen the graft fracture at the point where it protrudes from the bone. But Camera has imitated Toupet by using a tibial graft, which he inserts obliquely in the astragalus, allowing its posterior extremity to project. It is to be noted that this graft is much shorter than that of Toupet, and is held in nearly its entire length, in the astragalus, and is, therefore, less likely to fracture. He employed it in one case of spastic paralysis, and in three cases of infantile paralysis, but the results date back only from one to three months.

The procedure of Campbell attempts to make behind on the tibiotarsal articulation, a bony mass adherent to the posterior border of the astragalus, resembling a kind of olecranon. The operation is begun by a subastragaloid arthrodesis, in the course of which the scaphoid is removed, and several small pieces of bone. These fragments, freshened in all their surfaces, are heaped up in a mass, which is in a small area made in the soft parts in front of the tendo Achillis, and in contact with the posterior border of the astragalus which is also freshened. He reports having performed this operation twenty-four times, and examples which he gives of his work

*"Artrorise", the original word applied by Putti to this procedure, is used throughout this article, as there seems to be no exact English equivalent.—*Editor.*

show that the results obtained have remained permanent at the end of a year. He fashions at the posterior border of the astragalus either a rounded process of bone or a veritable hook.

But this procedure has the disadvantage of the loss of the scaphoid. Moreover, the pyramid, formed by the piling of the small pieces of bone behind the tibia, would be in a way sometimes less stable, and would be in danger of being crushed.

The procedure of the writer attempts also to develop a hook, resembling an olecranon, in cutting out of the upper surface of the calcaneus a piece of bone with osseous pedicle, which is raised vertically, and which then can be made to slide in front of the tendo Achillis.

The technique used by the author is as follows:

A long exterior curved incision with a convexity below, beginning at the external border of the tendo Achillis, four centimeters above the external malleolus, and passing two or three centimeters, according to the age, below the malleolus, then curves above to the level of Chopart's articulation, to pass over to the back of the foot as far as the extensor tendons. The extensor muscle of the toes, detached from its posterior insertion, is reflected to the front and to the inside. The peroneal tendons are exposed and are cut temporarily. The subastragaloid and the mediotarsal articulations are opened, and the foot luxated to the inside in order to open them widely. The astragaloscaphoid and the calcaneocuboid articulations are freshened, also the anterior subastragaloid articulation and the astragaloid surface of the posterior part of the subastragaloid articulation. Then with a chisel there is notched a facet on the calcaneus, with a base at the posterior portion of the subastragaloid articulation, and this then directed from behind forward and slightly from above to below, by the method of cutting a bony plate two to three millimeters in thickness in front, and one centimeter in thickness behind, where the pedicle is made. This plate is

FIG. 1
Posterior artrorise three months after the operation.

FIG. 2
The same, sixteen months after the operation.

then raised by turning it from before backwards, forming the base of this block, which is incompletely fractured, in which way the bony fragment becomes vertical, and rests attached to the calcaneus by the periosteum, and by the cortex of that part of the bone that is reflected. The foot is then replaced, causing the fragment of bone that has been raised to glide in front of the tendo Achillis. This movement is easy if care has been taken to prepare the bed for the graft, by cutting out the soft parts on the posterior surface of the tibia. The operation is then completed by suturing the long extensor of the toes and the peronei.

When the tendo Achillis is contracted, it can be lengthened by subcutaneous section, but it is necessary to make this section somewhat high, in order that the portion in contact with the graft should preserve its integrity, and be able to maintain the vertical position.

The foot is then put in position of flexion of eighty degrees, immobilized by the plaster bandage for two months. The bandage is then renewed, and worn another period of two months, during which time the patient is allowed to begin walking. At the end of four months the use of the foot without apparatus is allowed.

The writer has operated on twelve patients and in a thirteenth case, in which the subastragaloid arthrodesis had been done previously, the prop had been placed by means of a tibial graft, and planted perpendicularly in the os calcis. This graft was half absorbed in the space of eighteen months, and the support which was therefore given was insufficient. It is true it was longer than those of Calendra, and it was not placed in the same direction.

Of the twelve cases operated on by this procedure, in seven cases there were the "olecranon hooks", more or less resembling those which are shown in Figures 1 and 2, and 3 and 4. In general, these hooks are secured to the

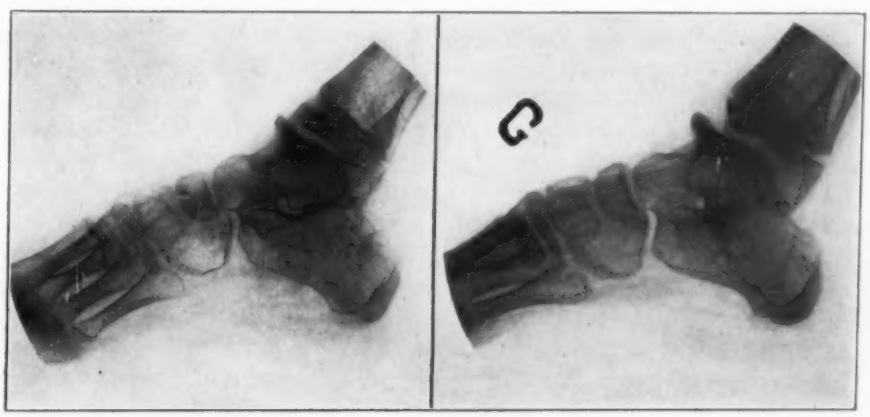


FIG. 3
Posterior artrorise four months after the operation.

FIG. 4
The same, three years and a half later.

calcaneus as one may see in Figures 1 and 2. They become thickened with time. In the case shown in Figures 3 and 4, the osseous union is not complete, but it appears at the same time that the process of bone has had a certain amount of mobilization, for there has been formed an articular facet on the back of the os calcis. This has remained for three years and it has become thickened and dense at the base, while it has also become somewhat vascular at its extremity. This proves that it has lived and it works effectively. Clinically all these patients had a good result. The support limits the plantar flexion to 100 to 110 degrees, and the dorsal flexion can be carried through an arc from fifteen to thirty degrees.

In two cases the hook did not hold, and there has been made in this place a bony mass, sufficiently prominent to establish a satisfactory support. This result resembles one of the cases of Campbell.

Moreover, in three cases, the result of an excusable fault in trying to formulate the technique of operation, the graft was broken while being put into place. Twice it has been absorbed more or less completely. One of these cases has a good functional result, for the extensor muscles have become stronger from the time when they no longer were obliged to support the whole weight of the foot. Camera has also observed this phenomenon. In the third case, the fractured graft is adherent in the portion the more in contact with the posterior surface of the os calcis, and strongly inclines toward the front, and is able to play the part of a support.

It is seen in general that clinical results have been obtained in eleven cases out of twelve, that imperfect results followed the first operations. The grafts are not absorbed except in the case where their pedicle has been broken in the course of the operation, and during a period of observation, which varies from six months to three years, we have not reoperated in any case of fracture.

The anterior artrorise is generally done according to the technique described by Putti. The neck of the astragalus is exposed by a longitudinal incision, and then by putting the foot in extension, a transverse opening is made by chisel at the level of the anterior border of the trochlea of the astragalus, and in this opening is sunk the graft, which Putti takes from the tibia, and which the author prefers to take from the calcaneus or the cuboid in the course of the subastragaloid arthrodesis. The results of this operation are numerous. Putti has reported twenty-five cases with twelve late results of which one was reported after four years. There was but one failure; the patient experienced pain at the level of the point of pressure of the support. All his other cases showed good results. Delitala has shown three cases dating from more than six months, and Camera also three cases. In the writer's clinic, this operation has been performed with five patients; three have had excellent results. With the two others the support was insufficient, the transplant being slightly inclined toward the front, probably because it was too slender in one case, and in the other it had been placed too obliquely.

It is seen from these cases that artrorise is capable of giving positive

and durable results. The blocking of the foot is obtained, leaving a mobility of from fifteen to twenty degrees quite sufficient to walk, and the inconveniences which had been predicted beforehand have not presented themselves.

It may be expected that the pressure of the bone is not well tolerated, but the case of Putti is the only one in which this bony support has provoked any pain. One can also expect that the limitations of movement in the tibiotarsal articulation should determine in the other articulations of the foot, the supplementary movements, which are susceptible of provoking either the arthritic pains or of developing deformity. This has not occurred, probably because the larger number of operators had performed at the same time the subastragaloid arthrodesis. Camera alone has not done this, but his results are recent, and it will be interesting to see what may happen in the future to them.

The most important question is that of the persistence of the bony support. One can *a priori* question if they will not be liable to be fractured or be absorbed. The results which we have seen at present, and which have been reported after three or four years, allow one to think that confidence may be placed in their permanency. Although fracture and absorption may take place, yet it appears that this can be explained either by fault of the technique, or by the difference in the value of the different kinds of graft.

Campbell observed from his experiments on animals, that the free grafts in compact tissue absorb and that only those persist which are placed into spongy tissue. This opinion is probably too absolute, judging by the number of permanent successes obtained in the anterior artrorise by the tibial graft which is used by Putti. Faldini has been able to study anatomically the astragalus, in which this graft had been placed, and he was able to verify radiographically and histologically that the union was complete. Meanwhile, one should not forget that the grafts, even those well placed, have sometimes a limited vitality, a certain amount of rigidity. It is known that the attempts which have been made to obtain a subastragaloid or tibiotarsal arthrodesis by transfixing the bone with a graft often failed because of the fracture of the graft. Reference has already been made to the fact that Ombredanne has seen this accident produced after the operation of Toupet. The writer has also observed a case operated on in his clinic, where the posterior support made by means of a tibial graft and placed vertically on the os calcis, was nearly completely absorbed in eighteen months. One can say that the long grafts of the compact tissue are exposed to fracture and absorption. The short compact grafts such as those of Putti in the anterior artrorise, and of Camera for the posterior artrorise, resist more because they are enclosed in the astragalus throughout nearly their whole length; but one should wait, however, before having definitely decided upon this question.

The free grafts of the spongy tissue have given good results to Campbell. The author has been able to obtain this result in two cases in anterior

artrorise, in which the graft was made one time by the superior articular facet of the os calcis and one time by the cuboid. The patients, seen at the end of sixteen and eighteen months, presented a solid support, which radiographically was evidently firmly adherent and thick. The one (Figs. 5 and 6) had a compact structure and had become evidently a part of the body of the astragalus. The other showed on its posterior surface, a lacunar aspect, but its anterior surface was compact. The two gave a definite proof of their vitality.

This proof is also more evident in the grafts of the spongy tissue made by following the technique described above for the posterior artrorise. In the case shown in Figures 1 and 2 the interval between the two radiographs is thirteen months. It can be seen that the support is organized perfectly and constitutes an actual body as a part of the bone. The same result has been seen in a recent case. In another operation, dating back seventeen months, there is also seen a complete union of the pedicle and the condensation of the support, but this one attained a more spongy appearance than the preceding cases. In another the conditions are somewhat unusual. The graft was extremely thin, although in the first observations, taken two months after the operation, it was nearly filiform. Two months later it increased in thickness four times. In the case shown in Figures 3 and 4, which was seen after three and a half years, the pedicle is not ossified and the graft remains separated from the os calcis by a clear line. Meanwhile, it has lived, it has manifestly developed, and continues to perform the rôle of a solid support. It does not seem that it is a question of fracture, but is a kind of pseudarthrosis which allows, meanwhile, the graft to be sufficiently nourished to remain.

Camera has expressed doubt as to the solidity of the graft obtained by

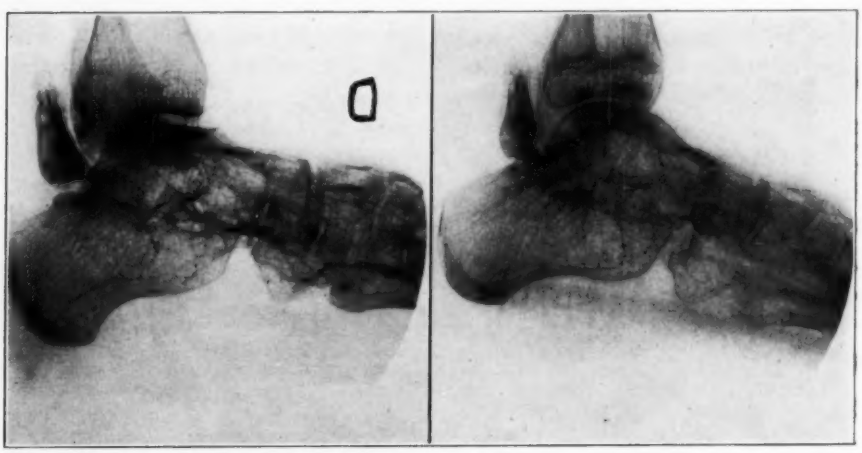


FIG. 5

Anterior artrorise four months after the operation.

FIG. 6

The same after twenty months.

this procedure by reason of the thinness of the pedicle. The last case is the only one which seems to justify this opinion, and is one of the first operations of the writer at a time when the technique was not well developed. It seems certain that it is possible to obtain constantly a sufficient pedicle in order that the graft should live, and to assure its union.

Considering these facts, it would seem that the graft of the spongy bone gives a fuller guarantee of its persistence and vitality, particularly when it is a question of the pedicle plate. In any case it can not be doubted that this method therapeutically should be entered among the practical methods, and in closing, these items are presented.

It is most applicable to the infantile paralysis case. After the partial failure of a tendon transplantation, one appears today to be in readiness to further attempt the consolidation of the paralytic club-foot, by operations on the skeleton, conserving the movements as much as possible. The subastragaloid arthrodesis of Ducroquet-Launay has made important advance in this regard; the artrorise has made another. The first aims to prevent the deformity of varus and valgus, and the second, on the contrary, is directed toward the equinus and the calcaneus. At first the author made these supports in cases of extensive paralysis, where the necessity of stiffening the knee and the condition of the other limb prevented the making of a complete arthrodesis. Now he feels that this indication may be extended to a large number of cases of the equinus or of calcaneus, and even to the incomplete paralysis where the weakened muscles by their stretching are not able longer to prevent the drop of the foot. Mechanical aid which is brought by a prop aids them and permits them to take up again their own activity to a greater extent.

In one case of flail-foot, an anterior and posterior artrorise were performed at the same time. Unfortunately, it was one of the cases already cited, in which the pedicle of the posterior graft had been broken during the time of its removal. At the end of the treatment the limitation of the movements was good in both directions, but the patient could not be seen again. The writer still thinks, however, that the indication can be regarded as correct. The same indications are found in cases of paralysis of the sciatic external popliteal, of traumatic or other origin, and in muscular lesions which have for one reason or another lost their action as extensors or flexors of the foot.

Camera has used this posterior support in spastic paralysis, with equinus, but of these he has reported but one case, and in this one the indications for the operation appear to be somewhat in question. The deformity being due to a tonic action of the flexor muscles, it is doubtful whether the support will be able to endure the constant pressure. On the other hand, however, the patients have much less opportunity to utilize the movements which remain in the tibiotarsal than those which have the flaccid paralyses.

TREATMENT OF SEVERE INJURIES OF THE LEG BY TRACTION WITH THE STEINMANN PIN THROUGH THE OS CALCIS

BY H. EARLE CONWELL, M.D., F.A.C.S., FAIRFIELD, ALABAMA

Orthopaedic Clinic of the Tennessee Coal, Iron and Railroad Company Employees' Hospital

In a series of five hundred cases of fractures of the shaft of the tibia and fibula, which were treated in the Orthopaedic Clinic of the Employees' Hospital, Fairfield, Alabama, one hundred and twenty-five of these cases were compound fractures which averaged a three and three-tenths plus damage to the soft structures, four plus damage being the maximum. (See table on page 282.)

The first forty of these compound fractures were treated by debridement and plaster cast[1]; thirty-five of the least severe of these injuries were treated by adhesive traction to the leg or with aid of the skate[2], with conservative surgery and later with circular plaster casts. The remaining fifty of this series of compound fractures were the most severe, and were treated by conservative surgery to the bones and soft structures, with traction by the Steinmann pin through the os calcis, and then later plaster casts.

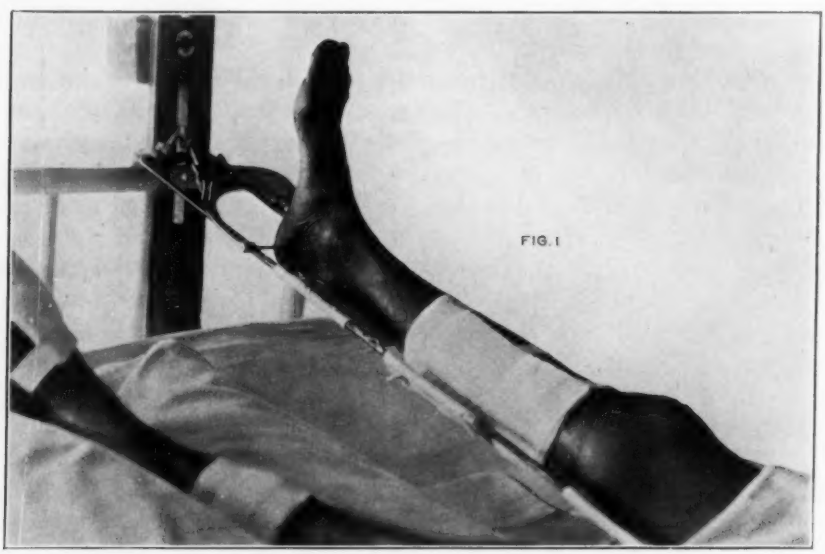


FIG. 1

Showing the Steinmann pin applied, with the leg in a Thomas splint and muslin strips underneath the leg. This patient had a compound comminuted fracture of the lower third of the right tibia and fibula with a severe involvement of the soft structures. Dressings have been removed from around the pin to show details.

Comparing these three methods, the results have been so far superior in the last two that the debridement and plaster cast methods have practically been abandoned. By using the Steinmann pin through the os calcis as an aid for traction, if properly used and applied in certain select cases, good results will be obtained where other methods fail.

A summary of the fifty severe cases is as follows: forty-five laborers (thirty-five ore and coal miners, ten steel workers); five civilians (one clerk and four housewives). Forty-six were males and four females. Age averaged thirty-three years. Right leg was involved in thirty-two cases and left leg in eighteen cases; upper third in ten cases; middle third in twenty-six cases; and lower third in fourteen cases. Every case was comminuted, forty-two were compound and eight were simple fractures. Four cases were due to gunshot wounds and one was due to an automobile accident. Tibia alone was involved in eight cases; tibia and fibula in forty two-cases. Soft structure involvement averaged three and five-tenths plus. In fourteen cases, when first seen, there was a question whether amputation should be done because of the severe soft structure injury.

Alignment was poor in three cases, fair in seven cases, and good in

FIG. 2

Showing a detailed application of the Steinmann pin through the external surface of the os calcis. Note that the Thomas splint is fastened to the bed and also to the upright at the foot of the bed which holds the main pull for the traction. By having this splint fixed it prevents a rotation or undue motion of the splint, the leg and the ankle. Dressing around the Steinmann pin has been removed to show details. The femur length pins are used because they enable a greater stabilization of the ankle and leg by having each side of the pin and the apparatus rest on the Thomas splint bars. Any amount of abduction or adduction of the ankle can be obtained by adjusting the thumb screw in the holes of the Steinmann pin holder. Generally the foot should be placed at right angle to the leg and mid-way between adduction and abduction.

forty cases. Anatomical position was poor in five cases, fair in twenty cases, and good in twenty-five cases. Non-union was not present in any case, but union was delayed in eight cases.

Number of days in Steinmann pin averaged twenty-five and seven-tenths days; days in plaster cast averaged thirty-eight and one-tenth days; days in hospital averaged thirty-one and six-tenths days; and months when walking averaged four and two-tenths months. Months returned to light duty averaged five and eight-tenths months; and months to full duty averaged six and four-tenths months. The longest period spent in the hospital was five and seven-tenths months; the longest period of the use of the Steinmann pin was thirty-eight days; the shortest period was twenty days. The longest period off full duty was ten months, and the shortest period off duty was four and five-tenths months.

Six of the industrial patients had a disability of the knee and ankle which prevented them from returning to the same kind of duty which they were doing when injured. (They are, however, able to earn a livelihood at a lighter form of industrial occupation.) With the exception of two other cases, of the patients who had an amputation of the opposite leg, but good results in the involved legs (Figs. 19-A to 24-B inclusive), all with industrial injuries returned to the occupation in which they were engaged at the time of injury. The civilians returned to their work earlier than the industrial patients.

FIG. 3

Author's pressure pad arrangement consisting of a flexible iron band .25 in. thick and 1.75 in. wide forming one-half of a circle. This band has a catch with a thumb screw at each end to be clamped on the Thomas splint. The apparatus can be applied anteriorly or posteriorly. The Pearson pressure pad can be applied at any angle necessary on the band. Note the author's foot upright, a 2 x 4 board with a groove in the middle along the upper one-half to allow the adjustment of the roller and block at any height necessary. This upright is ideal for application of any Buck's extension.

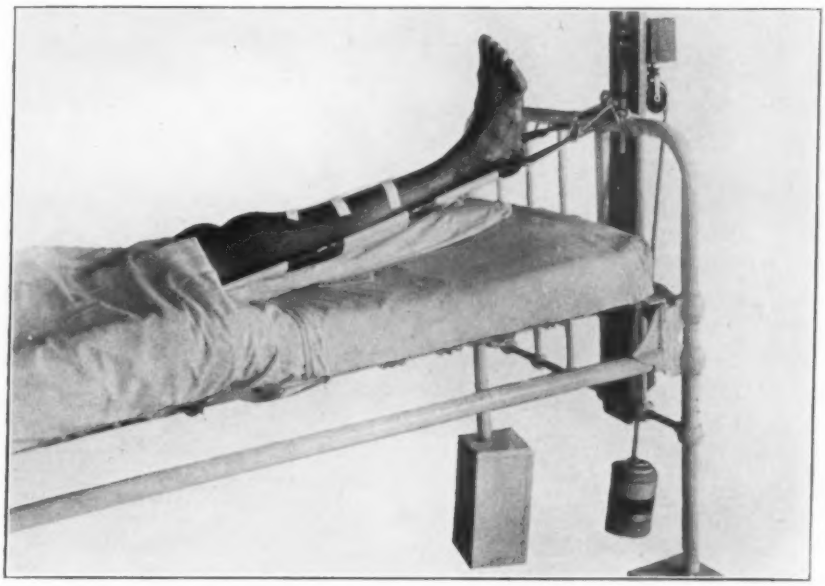


FIG. 4

Any treatment to the leg is very simple with such an apparatus. The muslin strips can be removed or any increased traction applied with any adjustment of the wooden foot upright, with very little discomfort, if any, to the patient and without any interference to the fracture.

FIG. 5

Foot of the bed with the traction applied. If any fixation of the proximal fragments is ever desired a circular cast can be applied around the thigh and Thomas splint from the upper half of the thigh down to the knee. This is seldom necessary.

Fig. 6. Showing average condition of os calcis immediately following removal of Steinmann pin. This leg had the circular plaster cast applied twenty-four hours previously.

FIG. 6

FIG. 7-A

FIG. 7-B

Figs. 7-A and 7-B. Showing average condition of the os calcis two and three months, respectively, following removal of the Steinmann pin.

FIG. 8-A

FIG. 8-B

Figs. 8-A and 8-B. Showing the average condition of the os calcis four and five months, respectively, following removal of the Steinmann pin.

No infection from the Steinmann pin nor from the wounds occurred, except from the slough resulting from the severely devitalized soft structures.

A study was made of the healing of the Steinmann pin application and it was found that the wound produced by the pin in the os calcis healed completely in an average of four and five-tenths months after removal of the pin and in some cases earlier (Figs. 6, 7-A, 7-B, 8-A, and 8-B). Good results from the application of the Steinmann pin were obtained in every case except one, where a cystic formation took place within the os calcis but cleared up a short time afterwards. This patient had no pain in os calcis at any time from this complication.

The Steinmann pin should be applied directly through the os calcis. It should not be applied through the soft structures alone, that is between the tendo Achillis and the os calcis, because there is grave danger of necrosis of the tissue occurring, as well as great pain, on account of the pull on the soft structures. Less pain was complained of from the use of the pin than in any of the cases treated by the other two methods. The consideration of pain is a very negligible factor provided the pin is applied properly. The pin should be removed as early as possible, for if it is allowed to remain too long it is liable to cause a dragging on the skin edges and soft structures, which would cause necrosis to the tissues, and possibly damage to the os calcis with pain to the patient. The time of removal of the pin is governed as much, if not more, by the condition of the soft structures as by the amount of callus formation between the fractures. In every case the muscles, nerves, and blood vessels were considered as the major complications. Union and healing were primarily dependent upon the soft structure involvement; the comminution of the bones was a secondary consideration, except where sequestra occurred and caused large gaps in the bone continuity.

By the use of the Steinmann pin through the os calcis for traction, excellent care can be given to the soft structures, the necessary amount of traction can be used over a prolonged period, and alignment can be

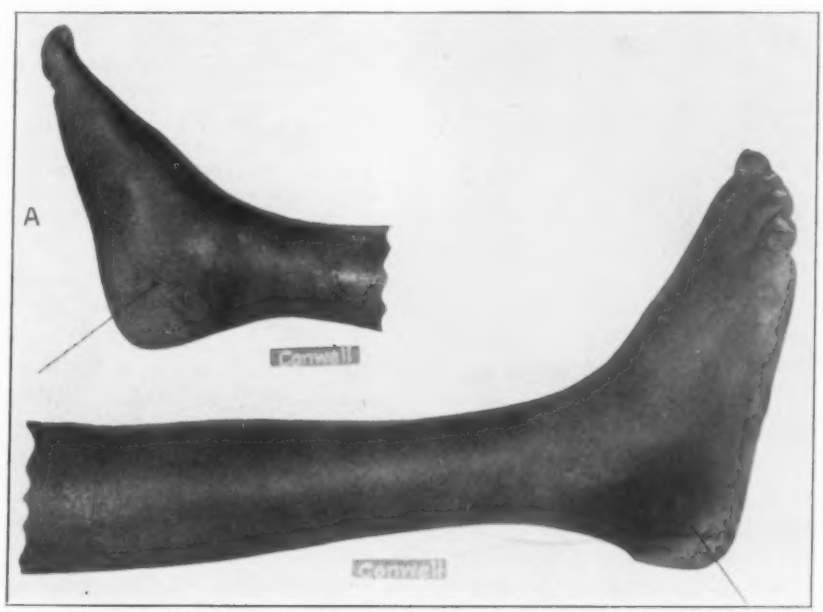


FIG. 9

Average condition of leg, foot, and ankle following removal of plaster cast. Note the Steinmann pin wounds have practically healed. (H. Earle Conwell in Scudder's The Treatment of Fractures. Ed. 10, Philadelphia, W. B. Saunders Co., 228–230, 1926.)

FIG. 10-A FIG. 10-B FIG. 11-A FIG. 11-B

FIG. 12-A FIG. 12-B

Figs. 10-A and 10-B. Compound comminuted fracture middle third left tibia in negro male, age forty-three, injured by having a rock fall on his leg. Severe soft structure injury, treated as described with excellent anatomical results (Figs. 11-A and 11-B), and excellent functional results six months later (Figs. 12-A and 12-B).

maintained, as well as any correction of any overlapping of the fragments. Radiant light and other forms of treatment can be carried out without difficulty; active and passive motion to the joints can easily be performed; frequent checks with x-ray can be made; dressings can easily be done; and proper care can be given to the soft structures or any compound wound. There is less pain by this method and better general care can be given to the patient.

Anaesthetics were given in every case in this series, ether in forty and nitrous oxide in ten. General anaesthetic should always be given when applying the pin and when operating on the leg, provided the patient's general condition will permit.

In the treatment of gunshot wounds no surgical interference was carried out in the beginning, except a cauterization of the wound of entrance

FIG. 13-A FIG. 13-B FIG. 14-A FIG. 14-B

Figs. 13-A and 13-B. Showing compound comminuted fractures lower and middle thirds right tibia and fibula in negro male, age thirty-five. Severe soft structure injury. Ore car ran over leg. Treated as described with excellent anatomical results (Figs. 14-A and 14-B), and excellent functional results five and one-half months later (Figs. 15-A and 15-B).

FIG. 15-A FIG. 15-B

and exit. If infection should occur in these cases, which is rare, incision and drainage can be easily carried out later.

The technique of the treatment in this series is as follows: Every precaution with first aid is taken. In just such cases disastrous results are sometimes seen from an improperly applied splint or no splint at all, which do as much as the injury to retard healing. Anti-tetanic serum should be given in every case.

All the deshocking measures are undertaken, following proper dressing of the wound and splinting of the fractures. Every case of this type should be hospitalized. Close physical examination of the leg is made and proper

radiographs are taken, anteroposterior and lateral views, and immediate decision made as to treatment. There should be no delay in attending to such an injury, and reduction should be done as early as possible.

All preparations are made for application of upright, for traction to the foot of the bed with a Thomas splint of proper dimensions, and elevation of the foot of the bed by the use of two twelve-inch blocks before beginning the anaesthetic (Figs. 1, 2, 3, 4 and 5). Anaesthetic is given to the patient in bed. Then the splints and dressings are removed from the leg while

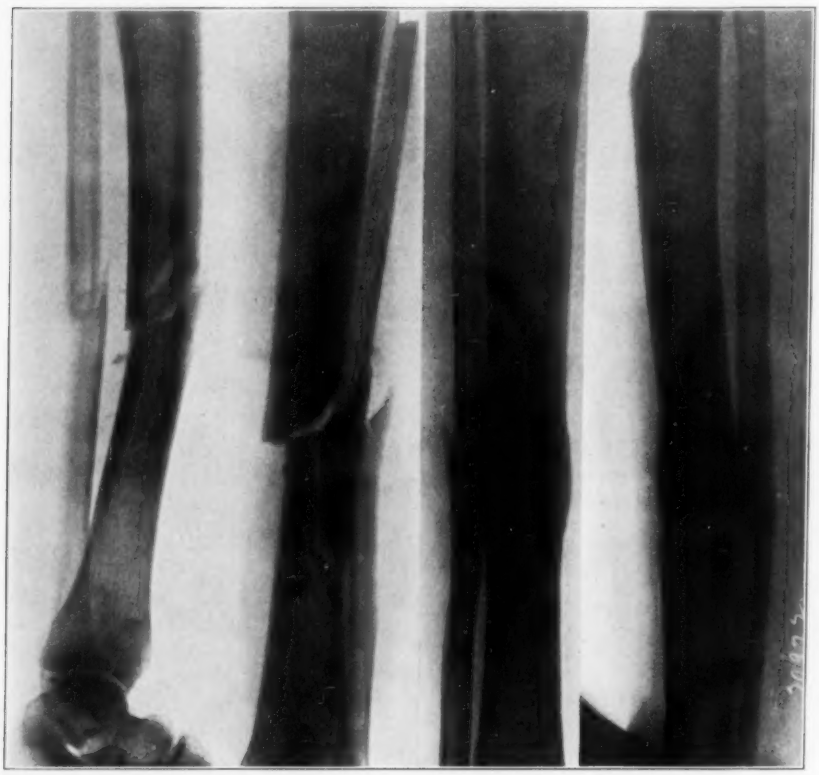


FIG. 16-A FIG. 16-B FIG. 17-A FIG. 17-B

FIG. 18-A FIG. 18-B

Figs. 16-A and 16-B. Showing compound comminuted fractures middle third of left tibia and fibula, in negro male, age forty-six. Severe soft structure injury. Hot steel rail fell on leg. Excellent anatomical results (Figs. 17-A and 17-B), and excellent functional results six months later (Figs. 18-A and 18-B).

continuous traction is being made on the leg at the ankle by an assistant. The leg, as well as the area over the os calcis, is shaved and cleansed thoroughly.

Technique as for a major surgical operation is carried out by the operator. After applying ether, alcohol, and iodin around the whole ankle and heel, the field of operation is draped. Before making the incision in the skin, the skin over the os calcis should be pulled up towards the knee so that there will be a redundancy of the skin and other tissues around the pin where traction is applied, thereby preventing any pull on the skin, the cause of a large amount of the pain in this type of treatment. A linear

FIG. 19-A FIG. 19-B FIG. 20-A FIG. 20-B

Figs. 19-A and 19-B. Showing compound comminuted fractures of the upper third and the upper end of left tibia in white man, age thirty-two. Severe soft structure injury. Ore car ran over both legs, necessitating amputation of right leg. Questionable at time whether amputation should be done on left leg. Treatment carried out as described with excellent anatomical results (Figs. 20-A and 20-B), and excellent functional results six and one-half months later (Figs. 21-A and 21-B).

FIG. 21-A FIG. 21-B

incision in the skin about one and five-tenths inches long is then made over the center of the external surface of the os calcis down to the bone. The pin is then passed through the os calcis slowly by a revolving movement of the pin, this being accomplished by holding the handle which is attached to the pin, and exerting an even force from the hand and forearm of the operator against the pin. As the pin passes through the opposite side, the internal surface of the os calcis, a grating sound is always heard. If inspection is then made on the inner surface of the heel, the point of the pin will generally be seen protruding through the skin. The same incision is made here as on the external surface, care being taken always to pull the skin towards the knee while making the incision. The Steinmann pin is then pushed half its length through the os calcis and the other part of the Steinmann pin apparatus applied with proper amount of traction.

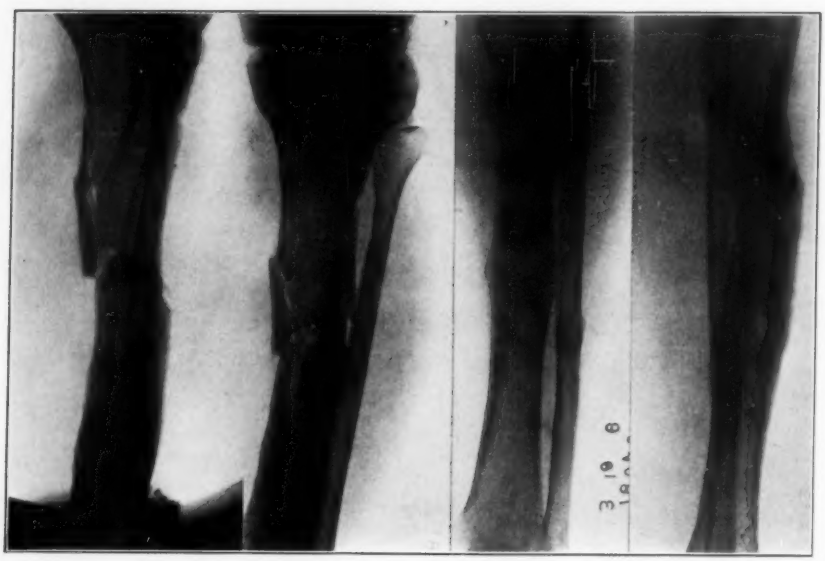


FIG. 22-A FIG. 22-B FIG. 23-A FIG. 23-B

FIG. 24-A FIG. 24-B

Figs. 22-A and 22-B. Showing compound comminuted fracture of the middle and upper thirds of the left tibia in white man, age thirty-three. Most severe soft structure injury. Coal car ran over legs, necessitating amputation of the right leg. Questionable whether left leg should have been amputated. Treatment as described carried out with excellent anatomical results (Figs. 23-A and 23-B), and excellent functional results six months later (Figs. 24-A and 24-B).

Maximum traction should always be applied immediately, this depending on the age and muscular development of the patient, and the amount of overlapping of the fragments, twelve to twenty pounds usually being the amount of weight necessary.

Following this procedure, attention is given to the compound wound on the leg. A complete change of gloves and gown should be made, as for a major surgical operation, and proper preparation of the wound. A generous amount of ether is used on the leg and in the wound after which the wound is washed out thoroughly with Dakin's solution. No other antiseptics were used in any of these cases and no infection occurred. All foreign material can easily be removed by using Dakin's solution. Every suggestion of hemorrhage is avoided and the wound made as dry as possible.

FIG. 25-A FIG. 25-B

Figs. 25-A and 25-B. Showing compound comminuted fractures, middle and lower thirds left tibia and fibula, with severe soft structure injury in a negro male, age thirty. Questionable as to whether amputation should have been done. Treated as described with good results (Figs. 26-A and 26-B).

No debridement is done unless there are completely detached pieces of bone or portions of muscle torn loose. No further damage to already damaged tissue is done. Following reduction of the fracture, the wound is closed with interrupted layer sutures, Dakin tubes are applied down to the depth of the wound, also subcutaneously and along the skin surface. Dakin's irrigation is kept up every two hours until all chance of infection has passed. Usually there is very little difficulty in the reduction of these fractures, especially after the proper amount of traction has been applied. In most cases the portable fluoroscope is indispensable.

All dressings are removed as soon as possible and coop light is used continuously. If any infection should occur following the

FIG. 26-A FIG. 26-B

discontinuance of Dakin's solution this treatment may be recommenced or warm moist dressings of weak solution of carbolic or boracic acid may be used.

After frequent checks with roentgen ray have shown that sufficient amount of union has taken place in the fracture to prevent any malposition, and all chance for infection has disappeared, and the soft structures are in good condition, a circular plaster cast is applied from the middle third of the thigh to the base of the toes. This cast should not be applied until one is certain that no sloughs of the soft structures will occur by being encased in a plaster cast.

FIG. 27-A FIG. 27-B

Figs. 27-A and 27-B. Showing severe gunshot wound in negro male, age forty, of lower third of right tibia and fibula. Questionable whether amputation should have been done. Good results (Figs. 28-A and 28-B). Alignment not perfect.

The cast is applied while the patient is in traction, thereby lessening any danger or possibility of the fracture getting out of position, or malalignment. The plaster encircles the pin on each side of the heel, windows being made over the pin areas following the removal of the pin, which should be within twenty-four hours after application of the cast. Windows in the plaster cast are made over the wound in the soft structures if necessary. In very few cases will it be necessary to give the patient any anaesthetic for the above procedure.

FIG. 28-A FIG. 28-B

The patient is allowed out of bed on crutches and usually discharged after a few days. Frequent observation is made in out-clinic. The anterior half of the plaster cast is cut away, usually about ten days or two weeks following its application, and at every inspection of the leg at the out-clinic department active and

passive motion is carried out at the knee and ankle joints. Frequent checks with roentgen ray are made, and as soon as enough callus formation has taken place to prevent malposition, all supports are taken off entirely. Hot baths are given and diathermy to the limb is commenced immediately.

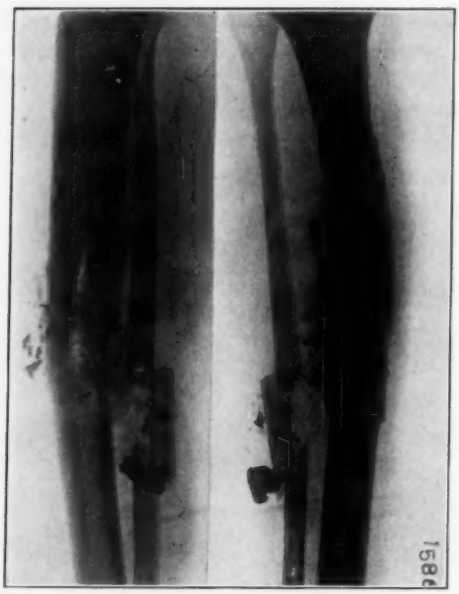
Weight-bearing is commenced gradually, according to the amount of union, and later with the complete discarding of crutches. Every patient should receive as close care following discharge as in the hospital and should be closely observed until patient has entirely recovered.

These patients demand the most competent surgical supervision and should be given attention both in hospital and out-clinic by the same surgeon, and this surgeon should at all times exert every effort to have the cooperation of the patient toward obtaining a good result. Surgeon and

FIG. 29-A FIG. 29-B FIG. 30-A FIG. 30-B

Figs. 29-A and 29-B. Compound comminuted fracture of the lower third of the right tibia and fibula in negro male, age thirty-six. Severe soft structure injury. Treated as described with excellent anatomical results (Figs. 30-A and 30-B), and excellent functional results (Figs. 31-A and 31-B).

FIG. 31-A FIG. 31-B



Figs. 32-A and 32-B. Gunshot wound of left tibia and fibula in negro female, age twenty-one. Treated as described with excellent results (Figs. 33-A and 33-B).

FIG. 32-A FIG. 32-B FIG. 33-A FIG. 33-B

patient are often responsible for bad results, frequently because of a temporary neglect on the part of one or the other.

The table showing how the average amount of soft structure injury was derived is as follows:

One plus were cases where there was a simple fracture with slight soft structure injury without comminution of the bone.

One and five-tenths plus were cases where there was a simple fracture, usually not comminuted, with a moderate soft structure injury and slight intramuscular hemorrhage.

Two plus were fractures where there was a punctured wound of the leg, with or without a comminution of bone or a compound fracture, and with moderate soft structure injury and intramuscular hemorrhage.

Two and five-tenths plus were cases where there was or was not a slight laceration through the skin and fascia, but with a severe soft structure injury and intramuscular hemorrhage with or without a comminution of the bone, usually not compounded.

Three plus were cases where there were one or more large lacerations extending through the skin and fascia and part of the muscle, with severe soft structure injury involvement, and marked intramuscular hemorrhage, with a compound comminution of the bone.

Three and five-tenths plus were cases where there was a deep laceration through skin and fascia and muscle exposing the bone, with a severe soft structure injury and marked intramuscular hemorrhage, with a compound comminution of bone with or without injury to the nerves.

Four plus were fractured legs with irreparable injury to soft structures, nerves, loss of blood supply, with or without comminution of the bone, demanding amputation.

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BIPARTITE CARPAL SCAPHOID

BY DONALD M. FAULKNER, M.D., RICHMOND, VA.

From the McGuire Clinic and Sheltering Arms Free Hospital

Pathologic processes in the carpal bones and joints are of comparative infrequency. The tarsus is much more commonly the seat of infections, as osteomyelitis, tuberculosis, and infectious arthritis, and of those conditions of doubtful etiology found in childhood, as Köhler's disease of the scaphoid and apophysitis of the os calcis.

The two most common lesions of the carpus are traumatic in origin,—fracture of the scaphoid and dislocation of the semilunar bone. The relative frequency of these has increased since the common use of roentgen rays has made demonstrable the actual lesion in many injuries formerly diagnosed as "sprained wrist". The roentgenologist has contributed to the pathology of the carpus another condition known as Kienböch's disease[1], a lesion characterized by fracture of the carpal semilunar, usually comminuted, associated with partial absorption of the fragments, but differing from the ordinary fracture in that a clear cut history of severe trauma is usually lacking. No such condition for the scaphoid has been described.

Fracture of the scaphoid is not very rare. If untreated or improperly treated, it is a very disabling condition, and skiagraphs of the wrist, with a correct interpretation of the findings, are essential to proper treatment.

H. Blencke[2] has recently laid stress on the importance to roentgenologists and to surgeons of an adequate knowledge of the accessory bony elements occurring at the base of the hand, and of the anomalies in the development of the carpal bones themselves. If the danger of a diagnosis of fracture is to be avoided, where in reality the so called fracture line is one due to development, this knowledge is necessary.

In his article, he quotes Pfitzner as authority for a bipartite scaphoid, consisting of two portions, radial and ulnar. This view, however, is not unchallenged. Tröll's opinion[2] is that the importance of the "naviculare bipartitum" is exaggerated. He believes that only when between the two fragments cartilaginous surfaces are present, can one say that there is a true bipartite scaphoid. In an examination of hundreds of serial sections of the wrist region of human embryos at various ages, Tröll has never encountered a bipartition of the scaphoid. From this he drew the conclusion that the bipartite scaphoid does not arise from two centers of ossification as an anomaly of development, but only as the result of injuries suffered.

This reasoning would cause the observer of a bipartite scaphoid to liken the condition to Kienböch's disease of the semilunar and to attribute the presence of a fracture line to an injury which caused a disturbance in

the nutrition of the scaphoid, with a subsequent spontaneous fracture of the weakened bone.

That true bipartite scaphoid does occur, though rarely, seems to be the opinion of most anatomists and embryologists in this country. Piersol[3] states that the scaphoid very occasionally develops by two centers of ossification. Jordan[4] mentions three possible methods by which a bipartite scaphoid may occur:

"First, persistent enlarged sesamoid bone on the radial side of the carpus, corresponding to the more constant and generally larger pisiform bone of the ulnar side;

"Secondly, persistence and progressive development of the primordium of an os centrale, a carpal bone of the manus of submammalian forms, represented by a discrete cartilage in the human foetus, which normally disappears;

"Finally, and most probably, according to some authorities, the scaphoid sometimes has two centers of ossification and a failure of normal union between these would cause the persistence of a bipartite scaphoid".

H. Blencke[2], in his report of a case of "naviculare bipartitum", diagnosed by x-ray, with no history of any trauma, concludes that the final proof of this condition having originated from two centers of ossification, would be only by showing the presence of cartilaginous surfaces between the radial and the ulnar portions of the scaphoid. Therefore, only at operation or at autopsy could this proof be obtained. In his case there were no symptoms from the abnormality to necessitate operation.

Recently a case came to the attention of the writer which afforded the opportunity to excise a bipartite carpal scaphoid. The presence of symptoms, unrelievable by the usual methods of treatment, led to the decision to operate and to remove the divided scaphoids and thus to settle, at least to our minds, the question of the existence of true bipartite scaphoid. The case report follows:

Mr. L. T. B., twenty-four years of age, a baker, was seen first at the office in June, 1926, and later, March 18, 1927, at the McGuire Clinic in consultation with Dr. J. Powell Williams. His chief complaint was pain and disability of the left wrist, with the same trouble, though to less degree, of the right wrist.

Four years ago his right ankle swelled and became very painful. After a small incision, from which pus escaped, was made in the swollen area, prompt healing occurred. No other joints were involved at this time. One year ago he began to have pain, swelling and tenderness of the left wrist. The pain was not severe except when he worked, kneading dough as a baker. Soon he was forced to stop work because of the pain attending it. No other joints were painful. He consulted his family physician, who told him he had tuberculosis of the wrist and put the forearm and hand in a plaster cast. He wore this for two months when he consulted another physician who put on a plaster splint for three weeks more and then advised him to return to work. Again the pain made his duties as a baker impossible. About this time he found a similar condition beginning in his right wrist. At no time were any other joints involved, but he did have some discomfort and soreness about his ankles and feet on standing and walking. He has never injured his wrists, so far as he can remember.

The past history was of no interest except for gonorrhea six years before, treated

for two months by a competent physician and pronounced cured, and for chronic constipation. His occupation in a bakery necessitated constant use of his wrists and hands, for ten or twelve hours daily, kneading the dough.

Physical examination was essentially negative, except for the wrists and the feet. The latter were flat, but showed no arthritis. In the left wrist, all motion was limited by muscle spasm, except for twenty degrees flexion. There was a marked prominence dorsally at site of os magnum. Crepitus was present on motion. There was tenderness on pressure over the scaphoid. Examination of the right wrist showed that dorsiflexion was limited one-half, with other motions free. Slight pain was present on motion, referred to the region of the scaphoid. A prominence on the dorsum similar to that noted in the left wrist was present, but it was much less marked.

The x-ray examination (Figs. 1 and 2) showed a "very marked, fairly symmetrical, bilateral deformity of the scaphoid bones in the hands. Each scaphoid consists of two pieces. All fragments are very irregular, having rather sharp edges. The wrist spaces are narrowed. The styloid processes of the ulnae and of the radii are sharpened.

"Conclusion: Two conditions are to be considered, the first being that each scaphoid ossified by two centers, forming a bipartite scaphoid, and that there was a superimposed infectious arthritis, causing a narrowing of the wrist joint space on each side with spur formation. The second condition to be thought of is that there may have been a severe osteo-arthritis attacking principally the scaphoid bone causing a pathological fracture of it together with a narrowing of the wrist joint space and spur formation of the styloid processes. The condition is practically the same on both sides."—*Dr. J. L. Tabb.*

Examinations of the blood and of the urine were negative as was the Wassermann test.

Fig. 1
Right wrist. Bipartite scaphoid.

Dr. Robert B. Osgood[5], who kindly reviewed the skiagraphs and the history, suggested, "a congenital variation of the carpal bones, probably in the nature of a bipartite scaphoid, with an imperfect joint between the fragments and a definite arthritis and proliferative changes as a result". He thought that the arthritis might be due to the old Neisserian infection.

Mr. B. was referred to Dr. Robert Bryan, who found gonococci in a prostatic smear. After two or three treatments for chronic gonorrhea, the man became discouraged and was not seen again for several months.

During this period he visited several other physicians, having x-ray treatment of the wrists and tonsillectomy performed.

When next seen at the McGuire Clinic in consultation, he was symptomatically worse. He could use neither wrist without pain, although the function in the wrists had changed but little since our first examination. When we had seen him before, our advice was that, if his condition did not improve after treatment of the gonorrhea, excision of the carpal scaphoids was proper. Dr. Osgood concurred in this decision.

The patient now agreed to operation and this was performed at the Sheltering Arms Free Hospital May 5, 1927.

Operation: Excision of carpal scaphoids. Dr. Faulkner, right; Dr. Graham, left.

A linear incision three inches long was made over the dorsal surface of the wrist between the long extensor tendon of the thumb and the extensor tendon of the index finger. The dorsal carpal ligament was split, exposing the scaphoid and the lower end of the radius. The styloid process of the radius was sharper than usual and there was an increased angle of inclination of the articular surface of the radius. The scaphoid was composed of two portions, a small ulnar part and a larger radial portion. There was no bony or ligamentous union between the two portions of the scaphoid; between

FIG. 2

Left wrist. Bipartite scaphoid.

FIG. 3

FIG. 4

Photographs of fragments of left bipartite scaphoid.

them were imperfect articular surfaces, covered with cartilage in which were small areas of absorption or destruction, as seen in arthritis. There was also evidence of arthritis in the wrist joint proper. The two portions of the scaphoid were removed separately, it being necessary on the right side to fracture the larger one in order to facilitate its removal. The carpal ligament was sutured with No. O catgut, the subcutaneous fascia with the same, and the skin with equisitine. No splints were applied.

Postoperative convalescence was uneventful and the patient went home on the sixth day.

After complete healing, physiotherapy was instituted and continued for six weeks with only moderate improvement in function; but the pain and soreness were much less. As before, the patient became discouraged by the slow progress and has failed to return to the office.

Photographs were made of the ulnar and radial portions of the left scaphoid after all non-osseous tissue had been removed by boiling. Unfortunately, the bones removed from the right wrist were lost, so that sections were not made, and therefore histological proof of actual cartilage over the articular surfaces between the ulnar and radial fragments is lacking.

Figure 3 shows the larger radial fragment above, so photographed as to show the concave surface into which the ulnar portion fitted. Below is shown the ulnar fragment with the surface presenting which articulated with the radial scaphoid. The small, multiple cavities show how much change had taken place in the bone at the site of the anomalous joint.

Figure 4 is a photograph to show the surfaces of the two portions opposite to those pictured in Figure 3. Above is seen the articular surface of the radial portion for the trapezium and the trapezoid. Below is shown the articular surface of the ulnar fragment for the radius. The surface of the radial portion which articulated with the radius is not shown.

The two portions when fitted together bore little, if any, resemblance to a normal carpal scaphoid. However, articular surfaces for all the bones with which the scaphoid articulates were present, the concavity for the os magnum being partly on the ulnar and partly on the radial portion.

CONCLUSIONS

1. Bipartite carpal scaphoid, with cartilaginous surfaces between the two fragments, does occur.

2. This abnormal joint may be the seat of arthritis.

3. The importance of a knowledge of this anomalous development of the scaphoid to the roentgenologist and to the surgeon is obvious.

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BACKACHE

Report for the Clinical Orthopaedic Society

BY R. WALLACE BILLINGTON, M.D., THEODORE A. WILLIS, M.D. AND ARCHER O'REILLY, M.D., COMMITTEE

At the last meeting of the Clinical Orthopaedic Society this Committee was appointed to make a report on backache.

The Committee felt that such a report would be of value only in so far as it represented the general opinion of American orthopaedic surgeons. The Committee interpreted the term backache to apply to those very frequent types referred to as sprains, lumbago, etc., and so has limited its report to those painful conditions of the lower back. To obtain this knowledge a questionnaire was sent to about 250 American orthopaedic surgeons. Seventy-nine answered, representing every section of the country.

Though inadequate, this seemed to be the best way to obtain an expression of personal opinion from a large and representative number of men.

This report is unbiased and does not express the opinion of any member of the Committee, except as he may have answered the questionnaire.

This report is divided into three sections.

I. A tabulation of the answers.
II. Backache, diagnosis and treatment, as indicated in the questionnaire.
III. Summary.

Part I.

Eight questions were asked. The answers to these in tabulated form are as follows:—

Question 1. In your opinion what are the causes of back pain?

This question elicited the largest number of answers. These are shown in Table 1.

Table 1.

Arthritis	58	Spondylolisthesis	7
Strain	51	Underdevelopment	7
Posture	50	Abdominal	7
Congenital anomalies	43	Flat-foot	5
Trauma	40	Fracture	3
Infection	28	Exposure	2
Pelvic	28	Constipation spasticity	2
Fibrositis	12	Auto driving	1
Varied	10	Luxations	1
Genito-urinary conditions	9		

Question 2. Which of these causes are the most common? Here again there was a fairly wide variety of opinion (Table 2), but the answers agree pretty closely with Table 1.

TABLE 2.

Arthritis	30	Sacro-iliac	9
Posture	18	Fibrositis	4
Trauma	17	Congenital anomalies	4
Strain	15	Pelvic	3
Infection, focal	10	Flat-foot	1

Question 3. Do abnormalities of the lumbosacral region play an important part?

TABLE 3.

Abnormalities—Lumbosacral

Yes	28
No	18
Factor	25
Slight	8

The general opinion is that, as a rule, these variations are not a primary cause of backache, but may be factors in causing or prolonging pain when associated with other causes.

Question 4. What is your opinion on sacro-iliac—dislocation? Sprain?

TABLE 4.

Dislocation—Sacro-iliac.

Seen after severe trauma	17
Never seen	3
Rare condition	20
No (statement without explanation)	2

TABLE 5.

Sprain—Sacro-iliac.

Common	39
Moderate	9
Rare	21
Does not occur	4
Yes (answer without explanation)	2
Undecided	1

This question was asked to get an expression of opinion on this debated question.

Question 5. How do you differentiate between the different types of low back pain?

Question 6. What form of treatment do you use?

The answers to these two questions cannot readily be tabulated, and as they are the subjects of Part II will be taken up in that section.

Question 7. Have you operated and if so, what have been your results?

TABLE 6

OPERATIONS

Yes	48
No	29
No reply	2

Operations		*Results*	
Lumbo-sacral	10	Good	8
		Fair	0
		Bad	1
		Not mentioned	1
Sacro-iliac	19	Good	15
		Fair	3
		Bad	1
Excision fifth lumbar	11	Good	3
		Fair	5
		Bad	3
Type or location of operation not mentioned	15	Good	8
		Fair	5
		Bad	2

The importance of operating only on selected cases is emphasized.

Question 8. If you have any new method of treatment, please explain in detail. The answers to this question are also taken up in Part II.

PART II.

In this section we will try to give a composite description of the diagnosis and treatment as obtained from the answers to Questions 5 and 6, using quotations when these seem to summarize the general opinion.

Arthritis, posture and trauma (Tables 1 and 2) are the most common causes of backache. Practically all the other causes mentioned can be classed under one of these types; so that for practical purposes these may be considered the main causes of backache. The fact has also been emphasized in many answers, that the three types are closely related, and that in most of the chronic cases all three are present, with arthritis or toxic absorption as the most important factor. Arthritis may result from trauma or postural strain, or a quiescent arthritis may become active as the result of trauma, even slight.

Diagnosis: A careful history and a thorough physical examination are essential for a correct diagnosis. Most of the answers stress this point. Especial attention must be given to elimination of foci of infection.

The acute traumatic conditions may be diagnosed by the history and the physical examination, localization of pain, and tenderness, muscle spasm, and the x-ray when there has been some bone injury.

The differential diagnosis between sprains and strains of the lumbosacral and sacro-iliac articulation causes most difficulty.

Differentiation is based on an attempt to localize definitely the pain in one spot and by the type of referred pain.

"Sacro-iliac versus Lumbosacral Pain.

"In sacro-iliac conditions tenderness along the inferior sacro-iliac ligament and at the sacrosciatic notch is found, while tenderness over the iliolumbar ligaments and the lower lumbar and first sacral spinous processes and supraspinous ligaments is found in lumbosacral conditions.

"*Standing:* In lumbosacral conditions that region is rigid, and forward bending takes place at the hip joints, while in attempting a backward bend the knees are flexed. In sacro-iliac conditions the bending forward takes place at the lumbar region until pain is experienced and the knee on the affected side is flexed, allowing the patient to bend still further. Bending backward is relatively free.

"In side bending the range is greater away from the affected side in lumbosacral lesions. From the *sitting position* forward bending is free in sacro-iliac cases. In lumbosacral lesions no difference is noted in the range of forward bending in this position.

"In the lying position the spine cannot be flexed in lumbosacral conditions because of the pain, but in cases of sacro-iliac strain pain is less than in the standing position.

"In *straight leg raising* pain before movement of the lumbar spine indicates a sacro-iliac condition. However, pain after the lumbar spine has commenced to move may be due to either condition. The leg on the unaffected side in sacro-iliac cases can be brought to a higher level without pain. In lumbosacral cases pain comes on at the same level on both sides.

"If there is pain on compression of the crests and over the pubis, it is in favor of a sacro-iliac condition.

"Pain in lumbosacral conditions may be referred along the fifth lumbar and first sacral to the anterior aspect of the leg and dorsum of the foot.

"Pain referred along the posterior aspect of the thigh—second sacral—generally indicates a sacro-iliac condition. In some sacro-iliac cases a click can be heard just before the limb reaches full extension, when being lowered from a flexed position. Adhesive tape strapping of the pelvis is used as a test, and relief of symptoms indicates a sacro-iliac condition."—*Meyerding.*

"In lower lumbar arthritis of a subacute or chronic type, the spasm of the back muscles, the localized rigidity, and decreased mobility on bending, plus the fact of positive tests taken lying prone (hyperflexion of the knee) produces irritation of the psoas in an attempt to raise the buttock. There is likewise spasm of the back muscles on an effort to hyperextend the pelvis on the spine by grasping the heels and raising the legs as in the ordinary Pott's disease test. In these cases the radiated pain is more apt to come through the anterior branches towards the hip joint and down the obturator, whereas, in contradistinction, in sacro-iliacs the pain is radiated into the buttock or down the back of the leg. In the chronic low back pain involving the lumbosacral junction and most commonly accompanied with postural factors, without the radiation of pain down the leg, there is localized pain in the region of the fifth lumbar and on either side out on to the ilium, frequently connected with anomalies. There is also a localized point of tenderness over the attachments of the iliolumbar ligaments on the crests of the ilium. Straight leg tests are usually negative. The hyperflexion test mentioned above may be positive or suggestive. The pain is localized and not radiated. Leg and pelvic measurements may be symmetrical, or, in many cases, there may be a pelvic tilt. This type is very frequently accompanied with faulty foot and leg alignment so that there is a continuous pull on the pyriformis muscle which crosses the sacro-iliac joint, attaching to the promontory of the sacrum and tending to drag the upper end of the sacrum forward as the legs rotate inward with the arches down. These cases that are

sensitive to pressure get worse under lifting. Occasional exacerbations may be influenced by toxic absorption, get worse under any intensive strain emotionally, and occur as a part of the general complex.

"In cases of sacro-iliac luxation, we depend for our diagnosis specifically on the following: Careful measurements taken in the standing position from the anterior spine to the internal malleolus and the anterior spine to the ground. This includes or excludes the arch which may be raised or lowered differently on the two sides. We also take the measurements from the mid-crest of the ilium to the ground on either side, and likewise from the posterior spine to the ground; also measurements lying down, taken from the anterior superior spine to the internal malleolus and from the umbilicus to the internal malleolus, in this case, one measurement including the pelvis, and the other excluding it. In consequence, given a case with a list to one side, localized pain over the sacro-iliac region, positive straight leg tests, radiated pain down the back of the leg, inability to twist or turn, pain on coughing or sneezing, with a measurement which shows a difference on the two sides (for instance, measurement from the anterior spine to the internal malleolus on one side being longer than on the other side with a contrary measurement from the posterior spine to the ground behind), shows a torsion of the pelvis. If the arches are ruled out in the standing position, the mid-crests may be higher on one side than on the other and may show a tilt as well. The combination tilt and twist is very common. For confirmation of these findings we depend on the x-ray picture, taken both in the lying and the standing positions, patient very accurately centered with a steel wire plumb line in the standing position to give us our exact relation to the plumb. If, for instance, the line passes through the middle of the symphysis and through the middle of the vertebrae, and yet the sacrum is not in the mid-line, and correspondingly, if the portion of the ilium which overlaps the sacro-iliac joints shows a greater difference on one side than on the other which corresponds to the clinical findings, we are certainly justified in making a diagnosis of a subluxed sacro-iliac."—*Lowman.*

Ryerson is not certain that sacro-iliac lesions cause sciatic pain; he has seen it in many lumbosacral lesions.

Hodgson has refuted several cases in which there was gross sacro-iliac displacement without sciatic pain.

Gaenslen places much reliance on his sign.

"Hyperextension of one hip with the opposite knee and hip acutely flexed,—to fix the lumbar spine, including the lumbosacral joint. Pain is present only in sacro-iliacs, ruling out lumbosacral cases."

An x-ray in most of these cases is of negative value only.

The diagnosis of postural defects is usually fairly easy. In addition to gross postural errors, foot defects must be looked for.

The diagnosis of arthritis is made on the history, the physical findings, the age of the patient in many cases, and the x-ray.

"Hypertrophic arthritis generally occurs in individuals past forty. There is generally less muscle spasm or none at all, but marked rigidity of the spine, differentiated from the rigidity of the spine in lumbosacral strain produced by muscle spasm. There is no pain produced by hyperextension of the thighs, straight leg raising or cross leg test. There are often numerous foci of infection and the x-ray picture will reveal the hypertrophic changes."—*O'Ferrall.*

Galloway voices the opinion of others in his answer.

"I am often in a fog regarding exact diagnosis in individual cases and do not get any nearer exactness as time passes. I regard the whole subject as involved and extremely difficult."

Genito-urinary and gynecological conditions should be eliminated.

"Pain in the middle of the back, over the sacrum and lumbosacral region, should always direct attention to the prostate gland and seminal vesicles. If there is a history of a venereal infection during any previous period, a most careful investigation of these structures must be made to be certain that no infection remains. This type of case belongs to the genito-urinary specialist, as no relief is obtained until all foci of infection have been eliminated."—*Rugh* (*Therapeutic Gazette*, Sept. 1925).

"Uterine trouble is more often overestimated than underestimated. However, in women backache of pelvic origin is often indistinguishable from static backache and the gynecologist should be consulted. In case of young girls it is safer to assume the cause to be static."—*Boorstein* (*New York State J. Med.*, June 15, 1927).

"Backache and deformity are due only in rare instances to disease of the pelvic organs.

"A careful examination will reveal other causes of pain, and will prevent the numerous unnecessary, often unsexing operations, all too frequently performed.

"Removal of the cause, and proper supporting measures will often give complete relief.

"The care of backache in women, as well as in men, is the responsibility of the orthopaedist and not of the gynecological surgeon."—*Kreuscher* (*Surg. Gynec. Obstet.*, Oct. 1927).

"I have also seen a case of carcinoma of the prostate whose first and only symptoms were low backache, no symptoms being referred to the genito-urinary tract."—*Kurlander*.

Treatment: In the acute sprains of moderate degree, many advocate adhesive strapping or rest in bed on a hard bed. Goldthwait says the rest should be applied in the position of physiological balance to rest the muscles.

In the severe sprains, rest in bed, or in a plaster jacket or plaster shell is advocated, if there is tilting or severe pain, traction may be used. Porter uses head traction if the pain is in the spine, and leg traction if pain is referred along a nerve. The general trend seems to be for longer and more complete rest. Sayre says six weeks; Mumford suggests two weeks after the patient thinks he is cured. The patient should also have physiotherapy and massage.

In the chronic cases belts, braces, corsets may be used. Physiotherapy is recommended by practically all. Postural defects should be eliminated. Muscle training has also been advised by some.

Manipulation under an anaesthetic may be used in acute strains. In some of the chronic cases it is useful, possibly by breaking up adhesions. James E. M. Thomson recommends the Jones manipulation. Cox (*Surg. Gynec. Obstet.*, Nov. 1927) describes a manipulation without anaesthetic which he claims is very satisfactory.

In chronic persistent cases of lumbosacral and sacro-iliac pain, operation is advised by many. This is the usual ankylosing operation.

Campbell (*Surg. Gynec. Obstet.*, Aug. 1927) describes an extra-articular arthrodesing operation of the sacro-iliac, in which he makes a raw gutter between the sacrum and the ilium into which is implanted a portion of the iliac crest.

La Ferte uses a bone graft operation.

"An Operation for Fixation of the Sacro-iliac Joint.

"A curved incision about five inches in length is made, beginning above the posterior superior spine and extending obliquely downward over joint.

"Soft tissues dissected down to joint.

"A hole three-eighths of an inch in diameter and one and one-quarter inches in depth bored into joint about one inch above posterior superior spine, the boring being done in such a manner that an equal amount of bone was removed from sacrum and ilium.

"A hole of similar dimensions bored about one inch below posterior superior spine in same plane, but not quite parallel with first hole.

"Bone grafts of similar dimensions from tibia driven into holes, these grafts being modeled in such manner that they would fit snugly but not tight enough to spread joint surfaces. Wound closed without drainage.

"The reason for not having the holes parallel is that no matter what the tendency to motion in the joint might be, it is absolutely prevented, the transplants acting as the key which holds the wheel to the axle. This is not only mechanically perfect, but more too; when union takes place between transplant and sacrum and transplant and ilium we have a condition similar to that presented when the key becomes rusted into the wheel and axle, the slightest degree of mobility being impossible."—*La Ferte.*

Arthritis: All foci of infection should be sought and removed. Patients should be given physiotherapy and eliminatives. If postural defects are present these should be corrected as much as possible. If the condition is acute, rest is indicated, either by support, or by rest in bed. Diet and general hygiene should be carefully regulated. The general condition of the patient should also be gone into carefully. Toxic absorption from the gastro-intestinal tract is most important. This phase should be carefully studied.

Albee impressed with the importance of gastro-intestinal toxaemia gives the following treatment:—

"The colon is treated with medicated colonic lavage; colon bacilli implantations are made; and a low residue diet prescribed which prevents carbohydrates from reaching the colon in undigested form, as their presence is known to favor toxic conditions. As Finker and von Wassermann believe that auto-intoxication is the result of bacterial activity on certain sugars, elimination of the offending sugar from the diet may be beneficial. Laboratory examination of the stool will reveal which sugar is the most active bacteriologically for a given patient, and this sugar should be eliminated from his diet.

"To forestall any possibility of residue protein reaching the colon undigested, or bringing with it partially digested carbohydrates and liberating them in the colon, proteins and meats are taken only in moderate quantities, and the importance of thorough mastication is impressed on the patient. The work of Kellogg at the Battle Creek Sanitarium has taught us much regarding the relation of diet and the action of the colon, and the influence of the colon upon health.

"To help restore the alkaline balance, doses of fifteen grains of calcined magnesia and fifteen grains of calcium lactate are given three times a day. Milk of magnesia powders are also given as necessary to relieve constipation.

"The medicated colonic lavage is given daily by the following technique, which is very important. The patient is placed upon the left side with the buttock elevated by means of two pillows. The reservoir (holding two quarts) is elevated not more than eighteen inches above the patient, in order that peristalsis may not be unduly stimulated, and an involuntary effort to expulsion of the fluid interfere with the treatment. A short glass rectal tip is used. A low enema of a pint of lukewarm water is first given to clear

out all faeces from the extreme lower portion of the colon. After this has been fully expelled, a second lavage consisting of two drams of calcium lactate in two quarts of warm water is allowed to flow slowly in; this will usually take about ten minutes. The patient is then requested, with the buttocks still elevated, to lie upon the back with the thighs extended for a period of two or three minutes, then on the right side with the buttocks still elevated for an additional two or three minutes, to permit the solution to flow as much as possible into the ascending colon and the region of the caecum. The patient is then allowed to expel all this fluid. This expulsion will be hastened by walking around a bit, and will consume from ten to fifteen minutes.

"The patient then takes the same position on the treatment table as before, and one dram of sodium carbonate monohydrated in two quarts of lukewarm water is allowed to flow into the colon in precisely the same manner as the calcium lactate solution, but is retained a few minutes longer than the previous one. The treatment should be continued daily until the last fluid comes away without much mucus.

"The case is then ready for colon bacilli implantations. Some cases will do well without them and the implantations are not, therefore, given routinely; but it has been found that in most cases their action contributes definitely to the relief of symptoms. The cultures should be obtained fresh from the laboratory and used within four hours.

"*Local mechanical treatment* in the form of belts, corsets, braces, etc., is applied when indicated, but the treatment just outlined alleviates local symptoms to such an extent that the need for local treatment is surprisingly diminished, and is entirely secondary.

"*Diet:* As has already been indicated, careful attention is given to the diet, eliminating whatever sugar is found by faecal examination to be particularly active bacteriologically for the patient under consideration, and restricting proteins and meats to moderate quantities, with attention to thorough mastication."

The treatment of low back pain as given by Lowman covers practically all of the points mentioned in the questionnaire.

"For acute traumatic backs where there is very much spasm or possible fracture, the case is put on a stiff bed in hyperextension, sometimes with supporting brace, or occasionally plaster casts; rarely the latter, because we institute physiotherapeutic procedures as early as possible. If these cases come to us a little late, two or three weeks to a month or two following the injury, still in spasm and great pain with possibly no evidence of organic structural faults, we put them in continuous Hibbs' traction, pelvic belt and halter, starting with five pounds on the head and ten or fifteen on the pelvis, increasing as the patient can stand it. We also use chloretone in doses sufficient to slack off muscle spasm, and institute physiotherapy. Then later we carry the patient over into a supporting brace, and continue the physiotherapy followed by corrective exercises until results are obtained.

"In the simple low back pain cases of a static nature with mild faults, we correct the skeletal alignment with a supporting corset or brace, particularly bridging over the hollow of the back in the hollow back and spondylolisthetic types, and decrease all mobility at the lumbosacral junction, put them on hydrotherapy, massage, and send them to the gymnasium for a course of exercises, alternating with the hydrotherapy, gradually beginning more and more active work, decreasing apparatus but maintaining attention to all faults in statics. In the bad cases that have reached the point where they have some simple strain, sprain, or are in subacute stage, we put them to bed and treat them as mentioned above for acute cases.

"In the arthritic cases and general spondylitis, where there is a great deal of pain with tendency to flexion of the back, flattening of the lumbar curve, with much pain and spasm, we also institute continuous traction for six to eight weeks with physiotherapy, diathermy, massage and cautious movements. In case the deformity is rather advanced and the arthritis is of a more chronic nature, we may give an anaesthetic and cautiously mold up the back into an extension position and put the patient to bed with continuous treatment as mentioned above, first correcting alignment, and then going after any

causative factor of the arthritis by looking into the intestinal tract with particular attention to protozoan infection and other foci of infection, particularly sinuses. In arthritics we pay very special attention to the intestinal tract and find that a very high percentage of them have intestinal protozoan involvement and infestation, and many are very greatly relieved by the use of emetin.

"In sacro-iliac luxations of moderate grade, where we have not a very great amount of pain or spasm we put on a supporting brace or corset and send the patient to the hydrotherapy department where an appropriate manipulation is prescribed to the physiotherapist, who after each relaxation cautiously attempts after his massage to slowly manoeuver the luxated ilium back into position. We do not make any violent movements at any time, just a cautious low pressure which very often accomplishes the purpose in six or seven treatments, without having to use the old type of manipulation under anaesthesia as formerly. We use traction on both legs, hyperflexion of the knees to the chest, hyperflexion of one leg with hyperextension of the other and pressure down on the prominent posterior spine of the luxated side. The patient's brace or corset is always put on on the table before he attempts the upright position. We pay especial attention also in these cases to the rest of the body statics. In bad sacro-iliacs we very frequently find that on being put to bed in continuous traction the pelvic belt traction (ten or fifteen pounds on the pelvis) often tends to pull the pelvis into alignment and just in the ordinary lying position will often readjust the position without forcible manipulation. In case these procedures fail we may manipulate under anaesthesia and put on casts followed by braces. I should like to say, however, that we have had to use this last procedure very rarely, not more than a few times a year, whereas, we used to do it a great deal.

"You will note then that throughout the low back pain cases we use continuous longitudinal traction in bed for a great many of the cases, and we find that in very obstinate cases, particularly of the impinging lower lumbar type, arthritics, and root irritations particularly, this type of treatment has given us very great satisfaction,—many times in cases which have been under other types of treatment chronically before coming to us. We can highly recommend it as a very favorable treatment. As it puts the patient to bed it has the benefit of rest and adequate treatment in recumbency which cannot be obtained in many of these chronic cases when the patients are running around. I should like to state that so far we have not seen fit to operate on any lumbar anomalies. We have had considerable satisfaction by other methods of treatment."

Several of the answers stressed the importance of treating the patient as well as the condition. Rugh says,

"Treat both patient and condition; there is no such thing as a standardization of the treatment in these conditions".

Kidner expresses himself in the same way:

"The problem of low back pain is a serious one in my experience and I feel that treatment should almost always be based on the reactions of the individual case, with special reference to the mental attitude of the patient."

A. Whitman gives the following warning:

"I think the commonest errors in the present day diagnosis and treatment of low back pain are due to the narrowness of the point of view. All orthopaedic surgeons regard the patient from the mechanical standpoint—all gynecologists from the gynecological standpoint, etc. There is also much controversy as to the differential diagnosis between lumbosacral and sacro-iliac lesions. It seems to me not only possible, but probable, that particularly in traumatic cases the two may coexist. This possibility should at least be considered."

Two quotations seem to summarize the feeling expressed in a large number of the answers.

"I have been struck lately with the number of cases of spondylitis following strain, and I feel that this is a very common complication."—*Henry.*

"Most of these cases of low back pain date from a definite injury. They are very seldom treated efficiently and as a result there is a superimposed osteo-arthritis. If these cases were treated efficiently after injuries, there would be less chronic low back pain." —*Berkheiser.*

Part III.

SUMMARY

This review of the answers to the questionnaire shows that there are many opinions on low backache, but on the whole there is a fairly definite agreement, not only as to the main causes of backache, but also in general as to treatment. The chief point of difference would appear to be on the question of sacro-iliac sprain. The majority believe that there is such a condition. Those who do not believe in a sprain or strain, are very firm in their beliefs. Nothing has appeared in this study to prove or disprove the contention.

It does seem, however, to be possible to outline a fairly consistent course of treatment based on the cause and diagnosis.

The causes of low backache are broadly arthritis, trauma, and posture.

Arthritis may include osteo-arthritis, and the toxic conditions, due to intestinal absorption, or foci of infection including the teeth, tonsils, sinuses, gall-bladder, and other points.

The traumatic conditions include those forms of backache which are the result of direct trauma.

Postural backache is due to static errors resulting in muscular, ligamentous and possibly long strain, due to improper alignment.

The so called anomalies of the fifth lumbar and first sacral can reasonably be put in the postural group. They probably do not begin to cause symptoms until their alignment has been disturbed as a result of some postural defect or trauma.

These three types, although apparently clearly differentiated, are in reality closely associated, and one form may induce one or both of the others, so that in chronic backache all three may have played an important part.

A careful diagnosis must be made in all cases, based on a careful history, past and present, and a careful physical examination, including a gastro-intestinal, and a search for all possible foci of infection.

The acute traumatic conditions are diagnosed by the history and physical findings, by muscle spasm, localization of pain and points of tenderness, and by the x-ray when there has been some bone injury.

Differentiation between sacro-iliac and lumbosacral lesions causes the greatest difficulty.

In sacro-iliac strain there is pain over the sacro-iliac joint and in the sacrosciatic notch. Straight leg raising, especially before the spine begins

to move, causes pain in the joint, as is also the case with the cross leg test. In lumbosacral the pain is higher and nearer the mid-line. In lumbosacral conditions straight leg raising is apt to cause pain on both sides. In sacro-iliac, pain is referred down the back of the leg; in lumbosacral, down the front of the thigh. In sacro-iliac, compression of the crests of the ilium may cause pain.

In lumbosacral conditions that region is rigid, and forward bending is at the hips. In sacro-iliac the forward bending takes place in the lumbar spine. In the sitting position forward bending is free in sacro-iliac conditions; in lumbosacral lesions no difference is noted.

The importance of a definite diagnosis between sacro-iliac and lumbosacral lesions is evident if some operative procedure is to be undertaken.

Postural conditions are usually easy of diagnosis, but in this connection the feet must always be considered.

Arthritis can be diagnosed on the history, the physical findings, and the x-ray. In the early arthritic cases and in those cases due to toxic irritation, the x-ray may be negative.

Treatment: In the acute traumatic conditions the treatment is of rest, followed by physiotherapy. Rest may be obtained in the milder cases by adhesive plaster strapping. In the severe cases recumbency is necessary, if in bed, the bed should be hard. In the more severe types a plaster jacket or shell may be necessary, with or without traction. The fixation should be as complete as possible. Rest should be continued for a considerable period.

Physiotherapy should be used as early as possible.

In some cases of acute sacro-iliac strain, manipulation may be used.

In chronic backache, all postural defects must be corrected, and when arthritis or toxic irritation is present, all foci of infection must be removed, elimination promoted, and the diet regulated.

Sacro-iliac supports and spinal braces and corsets may be used, together with postural exercises and muscle training and physiotherapy.

In old chronic and persistent cases, some ankylosing operation may give relief, provided the diagnosis has been carefully made. The removal of large transverse processes does not seem satisfactory, and probably as good results can be obtained by postural training and mechanical support.

BLOOD CALCIUM AND PHOSPHORUS IN PERTHES' DISEASE; A NEW CONCEPTION OF THE ETIOLOGY

Preliminary Report

BY HERBERT A. DURHAM, M.D. AND TOM A. OUTLAND, M.D., SHREVEPORT, LA.

Shriners' Hospital for Crippled Children

While changes in the lime-salt content of the areas involved in Perthes' disease and allied disorders seem to be a constant finding, there is apparently no data regarding the blood calcium and phosphorus in these conditions. At least a fairly comprehensive review of the recent literature fails to disclose any such data.

The apparent neglect of this phase of the subject may possibly be due to the tendency to regard these diseases as strictly local ones. If one of the three current theories (traumatic, congenital, infectious) is accepted, it would hardly be expected that changes in the blood chemistry would occur. However, the question of the etiology of these interesting disorders is by no means a closed one for, while there is evidence supporting each, no one is entirely satisfactory.

During the past six months we have examined six cases of Perthes' disease and one each of Sever's apophysitis and Schlatter-Osgood's disease. Our findings have been strikingly constant. In each case there has been a marked lowering of the serum phosphorus—1.50 to 2.01 mg. (average 1.76 mg.) per 100 c.c. serum. In five cases the serum calcium was also lowered, varying from 5.77 to 8.88 mg. and averaging 7.41 mg. per 100 c.c. serum. Three cases of Perthes' disease showed a normal serum calcium. In every case the calcium-phosphorus product was considerably below the low normal limit of 35, varying from 8.65 to 22.99 and averaging 15.40.

The earliest case,—onset of symptoms six months previous—showed a calcium of 6.71 mg. and phosphorus 1.62 mg. The oldest case,—onset of symptoms two and one-half years previous—showed a calcium of 10.54 mg. and a phosphorus of 1.83 mg. The most marked lowering occurred in the case of apophysitis,—calcium 5.77 mg., phosphorus 1.50 mg. The duration of symptoms in the latter case was six months.

These determinations were made in a reputable clinical laboratory under the direction of a competent pathologist (Dr. F. G. Ellis). Moreover a small number of cases of other conditions picked at random showed, with one exception, a normal calcium-phosphorus product. The figures therefore appear reliable.

The one exception noted above appears to be a case of sufficient interest to record.

The patient, a boy of nine years, came to the clinic with a complaint of pain in the right hip. The present illness had begun four weeks previous, at which time he began

to complain of pain in the hip, and to walk with a marked limp. There was no history of trauma. Examination showed a slightly undersized boy of nine years in a fair state of nutrition, who walked with a marked right limp. The right hip was held flexed by acute muscle spasm to 125 degrees. Slight painless rotation was allowed and flexion to full range. Adduction was normal, abduction slightly limited. There was no tenderness, swelling, or local heat about joint. The blood count was normal; Wassermann negative; Mantaux negative. X-ray of hips and lumbosacral spine was negative. Serum calcium 5.54 mg., phosphorus 2.01 mg. In the absence of any evidence of trauma or infection and in the presence of the blood change we felt justified in making a diagnosis of Perthes' disease. Traction was applied for a period of two weeks, during which time the deformity was corrected and spasm diminished. A spica was applied and heliotherapy advised. When the cast was removed one month later, the pain had entirely disappeared, but there was still slight muscle spasm. The x-ray was still negative, the calcium and phosphorus were still low. The patient was allowed up with crutches and a high shoe and subsequently weight-bearing allowed. Five months from the time of admission the hip was entirely negative. Examination of the blood showed a calcium-phosphorus product of 37.6.

We are of course unable to explain the exact significance of this case. In view of our findings previously described, it seems at least possible that this may have been an early case of Perthes' disease which, due to prompt relief from weight-bearing and restoration of lime salt, either spontaneously or due to heliotherapy, failed to progress through the usual stages. We are admittedly unable to prove this, but believe the explanation at least has the virtue of plausibility.

We do not feel justified in attempting to draw any definite conclusion from such meager data. However, we do wish to call attention to two other conditions in which the blood findings are similar,—both of them

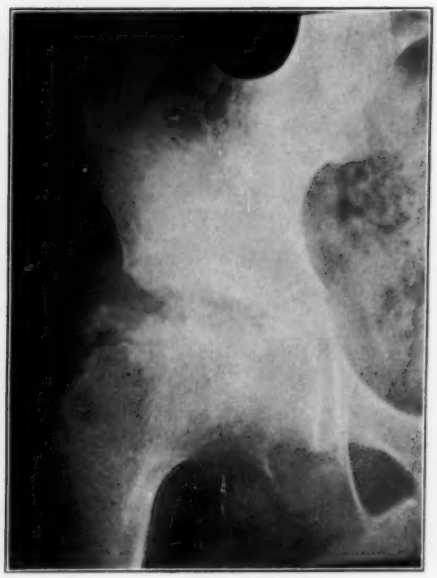

FIG. 1

H. M., male, age twelve. Duration of symptoms, twenty-one months.
Ca—8.88 mg: P—1.62 mg.

FIG. 2

T. H., male, age eight. Duration of symptoms, three months.
Ca—6.71 mg: P—1.62 mg.

FIG. 3

R. M., male, age twelve. Duration of symptoms, two years.
Ca—7.56 mg: P—1.68 mg.

FIG. 4

J. H., male, age eight. Duration of symptoms, six months.
Ca—5.77 mg: P—1.50 mg.

definite constitutional disorders and both classified as deficiency diseases, namely rickets and osteomalacia. It is particularly interesting that they present bone manifestations whose fundamental pathological characteristics are quite comparable to those of Perthes' disease.

Rickets. While the pathology of rickets has been described in minute detail, the following is a fair summary of the findings. The bones are thickened, especially in the region of the epiphysis, and lacking in normal consistency. Chemically they contain less mineral matter. On section the cartilaginous zone is found to be broad, irregular, and bluish; the line of ossification is wavy or irregular, poorly marked, and imperfectly calcified, the end of the diaphysis is irregularly thickened and expanded; the medullary spaces at the lines of ossification are unusually wide and the marrow itself is fibrous. There is an excessive production of osteoid tissue both by osteoblasts and apparently also by metaplasia of the cartilage, delayed and irregular calcification and resorption of bone that is already formed in excess of the production of new osseous tissue. As a consequence the bones become plastic and, under the normal stresses and strains, bending infraction and deformity occur. With recovery the bones become ossified and hard, but the deformities remain.

Osteomalacia. In osteomalacia the lesion consists in decalcification of the original bone and a more or less extensive formation of new osteoid tissue, which for a time at least remains uncalcified. Decalcification causes

a reduction of fifty per cent. or more in specific gravity and the consistency is such that the bone can be easily cut with a knife. The marrow spaces are enlarged and sometimes cystic. As a result an osseous tissue, poor in lime salt, is substituted for the normal bone. Here again fractures and deformities occur as a result of natural mechanical forces applied to softened bone. Among the various deformities the clover-leaf shape of the pelvic inlet, together with the close approximation of the inferior pubic rami and ischial tuberosities, is an important and characteristic one. After a period of years, with exacerbations and remissions, recovery may occur either spontaneously or under appropriate treatment, the deformities remaining.

Perthes' disease. McWhorter, in 1924, reviewed eight operated cases of Perthes' disease. The most comprehensive report is that of Phemister who made a pathological examination of a case operated on by Kidner. It is quoted in part:

" . . . . . This section from the piece of bone from the neck is triangular in shape and has a small island, apparently of the epiphyseal disc at one end. It is composed of cancellous bone with new bone along one side, which appears to be cortex. A part of the other side has apparently bordered on a cavity, as it shows an incomplete layer of fibrous tissue and old blood with osteoclasts, which are absorbing the bone. . . . The cancellous spaces of the bone are filled mainly with fibrous marrow, there being few hemopoietic cells. . . . These changes are mainly reparative, although some of them are absorptive, and there is no sign of inflammation in the newly formed unossified elements.

"The second section, consisting of cartilage of the epiphysis with a narrow margin of the center of ossification, shows changes in both cartilage and bone. . . . The cartilage shows some areas of degeneration and others of cartilage proliferation, with the formation of islands of fibrocartilage. The bony portion shows marked evidence of bone absorption and new bone formation, and the thick dense area at the middle of the section is apparently old dead bone as its lacunae are empty. There is new bone about its periphery which apparently is being formed as the old bone is absorbed and replaced by creeping substitution. I see no evidence of inflammation. The changes appear to be those of necrosis affecting both bone and cartilage, with absorption of cartilage and bone and replacement of dead bone by new bone.

"The third section, consisting of a thick layer of cartilage, shows little change in the peripheral portion along the articular surface, but extensive degeneration and absorption with partial replacement by connective tissue and fibrocartilage in its deeper portion where it is joined to the bone. There is only a small island of newly formed bone in the deeper portion of the section. . . . . .

"The changes in the epiphysis are both degenerative and reparative, the degeneration affecting the deeper portion of the cartilage and most of the bone. Absorption has taken place in both the damaged cartilage and bone and there is marked degeneration and replacement, particularly of bone without existing evidence of inflammation. . . ."

Here, as in the preceding diseases, due to the changes described, a softening of the affected bone occurs. Under weight-bearing, deformity gradually occurs in characteristic stages. There is preceding or accompanying these changes a malformation of the pelvic outlet, Jansen's ischium varum (The resemblance of the latter to the deformity of the pelvic outlet in osteomalacia is worthy of note in passing). After a variable period of time recalcification and reshaping occur and the disease subsides, leaving a certain amount of residual deformity.

Thus we have three conditions, distinct clinically, with different sites of predilection and affecting different age groups which, nevertheless, resemble each other in many important details. Each might be described as a non-inflammatory disease affecting bone with resulting softening and deformity. Each is characterized by bone absorption and bone production going hand in hand. There are differences possibly explained on the basis of the different stages of development of the affected bone. For example, osteomalacia and Perthes' disease being respectively diseases of adult life (generally) and adolescence, an important feature in their pathology is decalcification of already existing bone. Rickets, on the other hand, being a developmental disease, decalcification is less prominent although it does occur, and failure of calcification of the normal osteoid tissue is the important feature. The end result is the same, namely, the substitution of an osteoid tissue for true earthy bone.

There are other points of similarity. In rickets and osteomalacia the medullary cavities become large and even cystic and the marrow becomes fibrous and lacking in cellular elements. In Perthes' disease clear areas or cavities occur in the juxta-epiphyseal region and the marrow becomes fibrous and lacking in hemopoietic cells. As a result of these changes, in each one finds a period of softening followed by deformity.

Lastly, each seems to be characterized by definite changes in the blood chemistry—a reduction of serum calcium or phosphorus or both.

In view of the preceding, it seems possible that these conditions are related etiologically and further investigation along these lines seems highly desirable.

CONCLUSIONS

1. Perthes' disease is characterized by a diminution of the serum calcium or phosphorus or both.
2. The pathology is very similar to that of rickets and osteomalacia.
3. These three conditions may be related etiologically.

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THE INCIDENCE OF SUBASTRAGALOID DISLOCATION OF THE FOOT WITH A REPORT OF ONE CASE OF THE INWARD TYPE

BY A. R. SHANDS, JR., M.D., WASHINGTON, D.C.

From The Orthopaedic Department of the Johns Hopkins Hospital, Baltimore, Md.

A dislocation of the foot beneath the astragalus is a condition which is rarely seen. It is a dislocation which has often been confused with a partial or total dislocation of the astragalus, and one which has had many theories advanced to explain its cause. The following is the report of a case which was recently observed and treated in the Johns Hopkins Hospital Dispensary:—

CASE REPORT

History: The patient, M. E., a white woman of twenty-eight years, was carried into the Accident Dispensary on the morning of April 8, 1927, complaining of severe pain in the left foot and ankle. She had started to work about thirty minutes prior to this time in an automobile. Before the car had come to a full stop, she began hurriedly to get out. In doing so, her left foot had caught beneath the foot rail, and she was thrown out of the right door. She landed on the street with a considerable jolt, with her body facing towards the back of the car. The calf of the left leg had been skinned on the running board, and the left hip had received most of the weight of the body in the fall. She remembered a marked twisting of the left foot as she fell through the right door.

Examination: General appearance is that of a short, stocky, young woman, who is suffering extreme pain in the left foot.

Weight: 212 pounds. *Height:* five feet, one inch.

Local Condition—Left foot and ankle:

Upon inspection the two most noticeable points are the marked varus deformity, and the unusual prominence on the outer side of the foot. There is considerable swelling with slight cyanosis. There is a marked shortening of the dorsum of the foot, and a lengthening of the heel. The inner border of the foot is higher than normal with an adduction of the forward part of the foot. There is approximately fifty degrees of inversion and the same of plantar flexion. There is a generalized tenderness over the whole

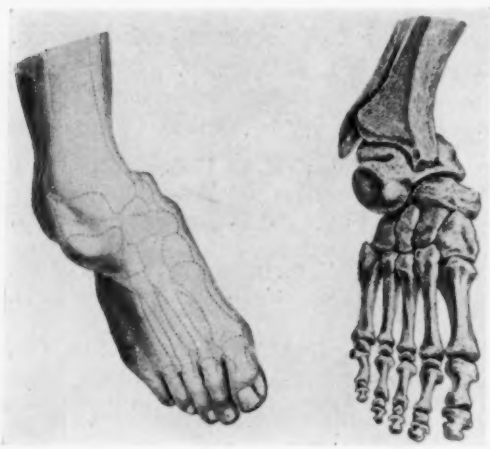

FIG. 1

Inward subastragaloid dislocation showing relationship of tarsal bones. After Anger and Hoffa in the System of Practical Surgery, 1904.

foot with the maximum point about the prominence on the outer side, over which the skin is quite tense. The prominence is smooth and regular, and is taken to be the head of the astragalus. The external malleolus can be palpated above the prominence. The least attempt at motion causes the patient to cry with pain. There is however about fifteen degrees of anterior posterior motion present. The internal malleolus can be barely palpated. Anterior to this the medial border of the scaphoid and the inner margin of the os calcis can be felt.

Under the fluoroscope, there was seen an inward displacement of the os calcis and other tarsal bones beneath the astragalus. X-rays were taken two hours after the accident.

X-ray report: "There is a complete medial dislocation of the os calcis from the astragalus, also of the scaphoid from the astragalus. The head of the astragalus is lying on the outer upper margin of the cuboid. There is also a moderate posterior displacement of the os calcis and scaphoid from the astragalus. The astragalus lies in its normal position between the outer and inner malleoli. There is no evidence of fracture of the tarsal bones, tibia, or fibula."

Treatment: A. Reduction. Under gas and oxygen anaesthesia two and one-half hours after the injury, the dislocation was reduced without difficulty. An assistant held the knee flexed and steadied the leg. With one hand on the heel and the other on the anterior medial portion of the foot, first the inversion deformity was slightly increased, and second a moderate amount of traction forward was made while the foot was forcibly everted. With this eversion, the dislocation was reduced, the bones

FIG. 2

Anteroposterior view of foot before reduction, showing medial displacement of os calcis and other tarsal bones. Outline of soft tissue shows extreme varus deformity.

FIG. 3

Lateral view before reduction showing posterior displacement of os calcis and other tarsal bones.

assuming their normal relationship with a soft clicking sound. Plaster was applied from the toes to the knee with the foot in the normal position.

B. After-care. The cast was left on for sixteen days. During this time the toes and lower leg were swollen and somewhat cyanotic in spite of the cast being cut and spread the whole length. Upon removing the cast, there was almost normal anterior posterior motion passively applied. Lateral motion was limited and accompanied with pain. Both malleoli were quite tender. In one month from the date of injury, the patient bore a moderate amount of weight on the foot and was able to discard one crutch. In six weeks she was walking without assistance, and in two months there was only a slight limp. Upon the last examination three months from the time of injury, the patient walked without limp; there was slight tenderness about the malleoli, especially the outer one; and the anterior posterior motion was normal, the lateral motion being about fifty per cent. of that in the normal foot.

FIG. 4

Anteroposterior view after reduction showing normal relationship of tarsal bones. Tube focused on astragaloscaphoid joint.

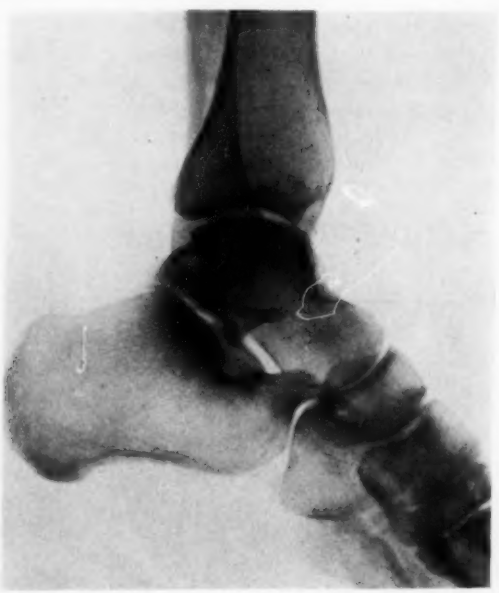

FIG. 5

Lateral view after reduction showing normal relationship of tarsal bones.

DISCUSSION

The interesting points of this case are: first, the manner in which the dislocation was produced; second, the absence of fracture; and third, the corpulence of the patient.

The mechanism of the inward type of subastragaloid dislocation is considered to be one of forcible supination and adduction of the foot. This may be combined with violence acting in the long axis of the foot or leg. In this case the foot was twisted beneath a rail as the patient fell

sideways out of an automobile door. The patient had started to leave the car before it had come to a full stop. The momentum of her body-weight of 212 pounds obliquely forward, plus the sudden thrust forward given to her body by the car stopping, exerted a tremendous force on the foot caught beneath the rail. After the dislocation had been produced, the foot slipped out from beneath the rail, and the patient fell to the street. Extreme violence was exerted on the foot, for the twist was sufficient to turn her body around 180 degrees.

Considering the mechanism of the injury, it would be thought likely that there would be an accompanying fracture. Careful and repeated examinations of the x-rays revealed nothing of this nature. Trendel in his review of eighty-two cases states that most subastragaloid dislocations are complicated with fracture, as does Richarz. Cotton in his textbook of 1910 says that the dislocation may rarely be complicated with fracture. Warren and Gould in their text-book of 1902 state that the dislocation is frequently complicated with fracture.

The extreme weight of the patient was certainly a factor in creating the dislocation. There is a reference to corpulence in three case reports of women, since Baumgartner and Huguier's report in 1907 on subastragaloid dislocations. There is no reference made to corpulence in the cases in men.

LITERATURE

The first reported cases of subastragaloid dislocation were in 1811 by Judcy and Dufaurest. In 1815 Sir Astley Cooper wrote of two astragalar dislocations, and later in 1825 mentioned these in his text-book on Fractures and Dislocations. In 1835 Nélaton made an anatomical dissection of a subastragaloid dislocation of the outward type; he also described this in his text-book on Surgical Pathology in 1847. In 1852 Broca before the Société de Chirurgie de Paris analyzed the scattered case reports under various titles, and gave a detailed systematic description of the different types. He described the inward, outward, and backward dislocations beneath the astragalus. Later in 1855 Malgaigne added the forward type. The classification of Broca and Malgaigne has since been almost universally accepted. In 1858 Henke added a great deal to the knowledge of the condition, as did Poinsot in 1877 with the collected statistics of the reported cases. Deetz in 1904, Trendel in 1905, and Baumgartner and Huguier in 1907, have all written of this dislocation at length, have reported cases of their own, and have reviewed the cases in the literature. The work of Baumgartner and Huguier stands out as the best in all the literature. In their publications, they have reported anatomical dissections and experiments on the four different types of dislocation. Reismann in 1907 published several excellent articles on the mechanism of the dislocation. Thienhaus in 1906 and Moore in 1922 have reported cases in conjunction with good articles on the subject.

INCIDENCE

A study of the literature to 1927 reveals a total of 138 reported cases. Eighty-five of these were collected and reviewed by Baumgartner and Huguier in 1907. The total of 138 cases plus the one of the author here reported, have been analyzed according to type, age, and sex, which statistics are given below.

I. Type	1. Inward	77	55.4 per cent.
	2. Outward	46	33.1 " "
	3. Backward	10	7.2 " "
	4. Forward	6	4.3 " "
		139	100.0 " "
II. Age	Between 10 – 19 years	10	9.3 per cent.
	20 – 29 "	36	33.4 " "
	30 – 39 "	17	15.7 " "
	40 – 49 "	23	21.3 " "
	50 – 59 "	16	14.8 " "
	60 – 69 "	6	5.6 " "
	Unknown	31	
		139	100.0 " "
III. Sex	Masculine	101	86.3 per cent.
	Feminine	16	13.7 " "
	Unknown	22	
		139	100.0 " "

Ratio — M : F :: 6 : 1

From the above statistics it is seen that the inward type of subastragaloid dislocation is the most common, and the forward type the rarest. The number of inward dislocations is greater than the sum total of the other three types. Some authors, such as Trendel, have divided the inward and outward types into two groups, first in which the dislocation is simply inward or outward, and second in which the dislocation is also posterior. The author's case here reported falls into the second group, however the first of these groups constitutes the major portion of the inward and outward types of the dislocation. The most common age for the dislocation is in the third decade between twenty and twenty-nine years. It is six times more common in men than in women. Baumgartner and Huguier state that it is nine times more common in men, while Trendel's statistics show eleven times. Eight of the nine cases in women reported since Baumgartner and Huguier's report in 1907, are of the inward type.

Trendel wrote of this type of dislocation being the rarest of those involving the astragalus. He reported that in Bruns' Clinic in Tubinger

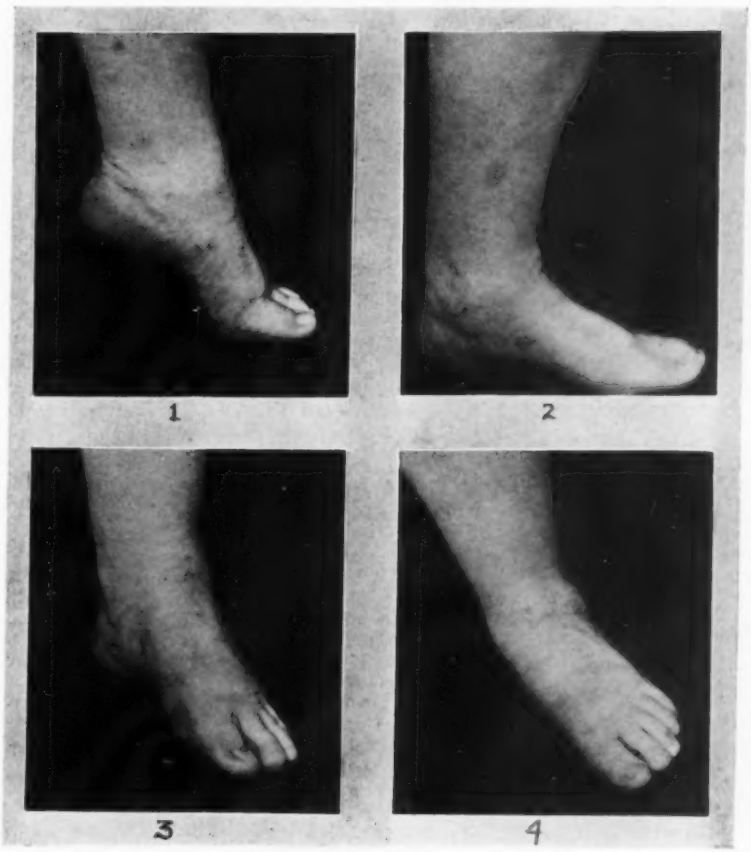

FIG. 6

Foot of case reported, three months after injury, showing amount of motion present: 1, plantar flexion; 2, dorsiflexion; 3, inversion; and 4, eversion.

the dislocation had been noted once in ten years, and that in the German Army once in thirty years. Stimson reported five cases seen in nine years out of 1,089 abduction and adduction fractures of the ankle. In St. Thomas' Hospital in London there were reported six inward subastragaloid dislocations out of 1,207 dislocations of all types, an incidence of forty-nine one-hundredths per cent. The case here reported is the first one in the records of the Johns Hopkins Hospital.

SUMMARY

1. One case of the inward type of subastragaloid dislocation without fracture is reported.

2. There are a total of 139 reported cases of subastragaloid dislocation in the literature.

3. The inward type constitutes fifty-five and four-tenths per cent. of this number, the outward type thirty-three and one-tenth per cent., the

backward type seven and two-tenths per cent., and the forward type four and three-tenths per cent.

4. The most common age is in the third decade between twenty and twenty-nine years.

5. The dislocation is six times more common in men than in women.

REPORTED CASES OF SUBASTRAGALOID DISLOCATIONS EXCLUSIVE OF THE BAUMGARTNER AND HUGUIER REPORT IN 1907

Type I.—Inward

	Year	*Author*	*Sex*	*Age*	*References*
1.	1900	Rutherford	M	13	Glasgow Medical Jounal, LIV, 423.
2.	1904	Grattan	M	—	Journal Royal Army Medical Corps, III, 182.
3.	1905	Debec	M	49	Thesis, Paris. (Rev. d' orthop., XXIV, 1, 1913.)
4.	1907	Reismann	F	18	Deutsche Ztschr. f. Chir., LXXXVI, 224.
5.	1908	Fink	F	—	Zentralbl. f. Chir., XXXV, 467.
6.	1908	Wrede	M	55	Deutsche med. Wchnschr., XXXIV, 1036.
7.	1909	Viannay and Goujon	M	24	Ann. de chir. et d'orthopédie, XXII, 120.
8.	1910	Stimson	—	—	Fractures and Dislocations.
9.	1910	Knoke	M	20	Deutsche Ztschr. f. Chir., CVI, 613.
10.	1910	Destot	M	40	Lyon chirurgical, IV, 197.
11.	1913	Paus	M	23	Norsk Magazin for Laegevidenskaben, No. 5.
12.	1913	Grune	M	29	Deutsche Ztschr. f. Chir., CXXI, 190.
13.	1913	Patel	F	35	Revue d'orthopédie, XXIV, 1.
14.	1913	Viannay	M	50	Revue d'orthopédie, XXIV, 1.
15.	1913	Viannay	M	44	Revue d'orthopédie, XXIV, 1.
16.	1913	Gayet	F	22	Revue d'orthopédie, XXIV, 1.
17.	1913	Egidi	M	51	Rivista ospedaliera, Rome, III, 352.
18.	1914	Delore	F	42	Lyon médical, CXXIII, 247.
19.	1917	Winnen	M	—	Berlin klin. Wchnschr., LIV, 939.
20.	1918	Quenu	M	21	Revue de chirurgie, LV, 380.
21.	1918	Chevrier	M	35	Bull. et mém. Soc. de Chir. de Paris, XLIV, 1902.
22.	1920	Steindl	F	40	Deutsche Ztschr. f. Chir., CLVI, 265.
23.	1920	Steindl	M	29	Deutsche Ztschr. f. Chir., CLVI, 265.
24.	1920	Steindl	M	21	Deutsche Ztschr. f. Chir., CLVI, 265.
25.	1921	Boerner	F	62	Deutsche Ztschr. f. Chir., CLXI, 135.
26.	1921	Wiart	M	18	Bull. et mém. Soc. de Chir. de Paris, XLVII, 241.
27.	1921	Mocquot	—	—	Bull. et mém. Soc. de Chir. de Paris, XLVII, 247.
28.	1926	Jensen	M	21	Hospitalstidende, LXIX, 406.
29.	1928	Author	F	28	Journal Bone and Joint Surgery, X, 306.

Type II—Outward

1.	1904	Bosher	M	19	Transactions Tri-State Medical Assoc., VI, 97.
2.	1905	Weyer	M	20	Thesis, Berlin.
3.	1905	Weyer	M	—	Thesis, Berlin.
4.	1906	Jeney	M	—	Wien. med. Wchnschr., LVI, 374.
5.	1907	Luxembourg	M	38	Deutsche Ztschr. f. Chir., LXXXVI, 127.
6.	1907	Zumsteeg	M	31	Beit. f. klin. Chir., LIV, 222.
7.	1907	Zumsteeg	M	39	Beit. f. klin. Chir., LIV, 222.
8.	1908	Roith	M	—	Beit. f. klin. Chir., LVIII, 394.
9.	1910	Stimson	—	—	Fractures and Dislocations.
10.	1912	Viannay and Fayard	M	60	Loire Med., St. Etienne, XXXI, 301.
11.	1913	Grune	M	16	Deutsche Ztschr. f. Chir., CXXI, 190.
12.	1913	Viannay and Fayard	—	—	Revue de Chirurgie, XLVII, 273.
13.	1913	Viannay and Fayard	—	—	Revue de Chirurgie, XLVII, 273.
14.	1922	Dehelly	M	—	Bull. et mém. Soc. de Chir. de Paris, XLVIII, 1409.
15.	1922	Dehelly	M	—	Bull. et mém. Soc. de Chir. de Paris, XLVIII, 1409.
16.	1922	Jones	M	39	Journal of Bone and Joint Surgery, IV, 325.
17.	1922	Moore	M	50	Surgery, Gynecology and Obstetrics, XXXV, 788.

TYPE II—OUTWARD (continued)

	Year	Author	Sex	Age	References
18.	1922	Moore	M	50	Surgery, Gynecology and Obstetrics, XXXV, 788.
19.	1922	Moore	M	52	Surgery, Gynecology and Obstetrics, XXXV, 788.
20.	1927	Sonnenschein	M	26	Journal of Bone and Joint Surgery, IX, 328.

TYPE III—BACKWARD

	Year	Author	Sex	Age	References
1.	1907	Luxembourg	F	30	Deutsche Ztschr. f. Chir., LXXXVI, 127.
2.	1908	Richarz	M	21	Deutsche Ztschr. f. Chir., XCII, 417.
3.	1923	Bolling	M	27	Surgical Clinics of North America, III, 365.

TYPE IV—FORWARD

	Year	Author	Sex	Age	References
1.	1906	Thienhaus	M	37	Annals of Surgery, XLIII, 295.
2.	1918	Smith	M	—	British Journal of Surgery, VI, 144.

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DISLOCATION AT THE OUTER END OF CLAVICLE

BY W. B. CARRELL, M.D., DALLAS, TEXAS

This shoulder disability, described by Dr. James T. Watkins, Dr. F. M. Cardenat, and others, results from laceration in the conoid and trapezoid ligaments. The force producing it is a downward thrust of the shoulder, usually from an impact on the acromion. Excursion of the clavicle is checked by contact with the first rib, and if it is not broken, the acromioclavicular and conoid and trapezoid ligaments may be torn, permitting abnormal mobility and upward displacement at the outer end of clavicle. Section of the acromioclavicular ligament does not influence the position of the clavicle, but if the conoid and trapezoid are then divided, immediate deformity will follow.

From clinical observation, it would seem that repair of a complete laceration is possible, when the clavicle is held firmly against the partially immobilized shoulder, immediately after the accident and for a period of three weeks. Recently the writer treated a patient in this manner, and

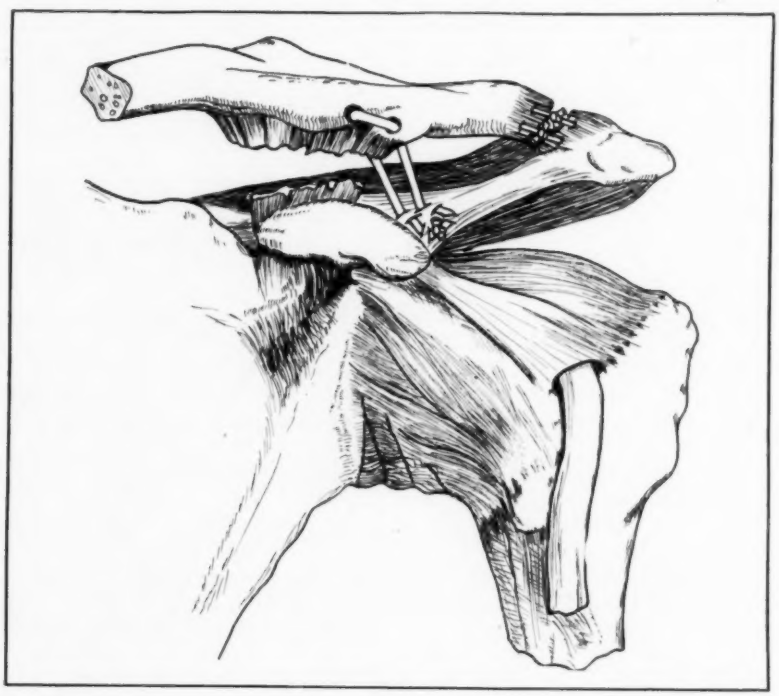

FIG. 1

Strip of fascia from the thigh, passed through drill holes in the clavicle and attached to coraco-acromial ligament.

the clavicle from the position of wide separation and free mobility, became firmly fixed with only slight deformity, but complete function after eight weeks.

In two cases operated on, we have been able to confirm the presence of complete severance of these ligaments and have restored the anatomical relation and normal function by substitution of a new ligament, following the principle formulated by the authors mentioned. One of these, a student, had been disabled four months with shoulder weakness and limited abduction. Since operation he has participated in football for two seasons, and the shoulder is normal in every function. The other case, a child six years old, is, on account of the age at which this injury occurred, so unusual that the writer feels justified in calling attention to work previously reported. Three weeks after a fall on the shoulder the clavicle was freely movable and presented an ugly deformity of the shoulder. On exposure, the conoid and trapezoid ligaments were torn, with fragments hanging at either attachment, but combined were not sufficient to approximate more than one-half the distance between the coracoid process and the clavicle. A new ligament was made and complete function established.

Without change in the fundamental idea of Dr. Watkins, some variation was made in the technique as shown in Figure 1. A strip of fascia, one-half inch wide and four and one-half inches long, is passed through two drill holes in the clavicle and woven in the base of the coraco-acromial ligament. This latter ligament is directed upward and outward, and is almost at right angles with the new ligament, thus facilitating attachment with proper tension. The acromioclavicular ligament may be repaired with fascia or chromic catgut. The attachment on the coraco-acromial ligament is preferred, because it is more easily accomplished, and has proved adequate in the two cases reported.

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THE OPERATIVE TREATMENT OF SCOLIOSIS

BY BARCLAY W. MOFFAT, M.D., NEW YORK

Spine fusion was first applied to cases of scoliosis by Hibbs[1], who reported in 1924. Since this time many cases of this deformity have been operated on by various surgeons, following various techniques.

In considering the value of this form of treatment, the subject falls naturally into two divisions,—the indications for operation and the technique of operation.

There are in general two opinions held by those advocating this form of treatment,—(1) that the operation in itself is corrective to some extent, and (2) that the operation is used simply as a substitute for external support. The treatment applied by the first group of surgeons consists, in the main, of traction in bed on a frame for a period of about six weeks, looking to the correction of the deformity. This traction is applied by the Sayre halter to the head and countertraction to the pelvis. To this is added, by some men, lateral traction at the apex of the curve. Following this the spine is fused by one of the various techniques, and the traction is continued throughout the period of convalescence.

The arguments advanced in favor of this form of treatment are:

1. That the plaster jacket treatment in general use is unnecessary and tedious, inasmuch as by the above form of treatment it is possible to obtain the maximum degree of correction.

2. That the operation, freeing as it does the insertion of the erector muscles, allows more rapid correction.

3. That the theory of correction by plaster jackets is unsound in that the pressure of the jacket is applied to the thoracic cage rather than to the spine itself.

Considering the first of these arguments, it would seem that the deformity of scoliosis, involving as it does malshaped vertebrae and shortened ligaments as well as muscles, is too complicated to allow the maximum of readjustment in the short period of twelve weeks. It would seem more reasonable to suppose that the action of a force applied gradually over a period of many months, would be necessary to reshape the structures involved in the case of scoliosis. In fact the rôle of the muscles in maintaining the deformity in scoliosis, must be a minor one, for it is not possible to straighten the spine manually when the muscles are entirely relaxed under anaesthesia.

This method does not take into consideration vertebral epiphysitis, as a factor in the etiology of scoliosis. The recognition of this condition and its possibility as a factor, was first pointed out by Scheuermann[2] and more recently by Buchman[3], who brought to bear a vast amount of clinical

evidence on the subject. Whether his conclusions are accepted or not, at least the writer has found his theory a useful working hypothesis.

In looking back over the cases operated on before this condition was recognized, many were found to have developed a new curve outside the area of fusion, whereas those cases which showed no evidence of active epiphysitis, at the time of fusion, did not relapse. If it is admitted that this condition may be a factor in scoliosis, it is obvious that twelve weeks is too short a time of immobilization for the arresting of the disease. If it were true that the correction of deformity by jackets was accomplished solely by the force transmitted from the jacket through the ribs to the spine, this argument might be considered as valid. However, it has always been the theory that whatever correction was accomplished by jackets was brought about by limitation of expansion of the chest on the side of the convexity and a resulting development of the muscles on the concave side. That these muscles play a rôle in the formation of scoliosis, is evidenced by the fact that in unilateral paralysis of the back muscles, the concavity is always on the side of the paralysis.

Those who believe that the operation should be used as a last resort and simply for internal splinting of the spine, believe it is possible to correct a large majority of the cases of scoliosis by the use of jackets, and thus avoid the necessity of operation.

Those who are willing to accept the rôle of vertebral epiphysitis in scoliosis, realize that immobilization will be necessary over a long period, whether operated on or not. Again, the use of the jacket as a permanent support in irreducible cases, leads to further malformation of the chest and limitation of the respiratory capacity, which has proved fatal in a number of cases in which pneumonia later developed.

The cases of severe scoliosis, in which occurs wide deviation of the spine from the mid-line, must necessarily become worse under the constantly acting force of gravity and therefore must be given support.

There are various techniques designed to produce a fusion of the vertebrae of the spine in the area involved in a curve. The first of these techniques is that of Hibbs, and all other operations are to a more or less degree, a modification of his procedure. Hibbs' operation was first described as a method by which the reparative processes of nature in Pott's disease of the spine, would be simulated, thus hastening a cure.

The drawbacks of this form of spine fusion, as applied to scoliosis, which occur to the writer, are the following:

1. The technical difficulties. The dissection must be most careful, lest the inclusion of fibrous tissue at the level of any vertebra should prevent ossification and union with the vertebra above. As a result the operation is of long duration, that is, at least an hour.

2. The severe cases of scoliosis, that is, those most needing fusion because of poor statics, cannot be fused by this technique. The erector muscles of the convex side at operation are found crowded over the tips of the spinous processes with the line of cleavage well on the concave side of

the spine. It is impossible to retract these muscles far enough to reach the lateral aspect of the spinous process on the convex side, to say nothing of attaining the lateral articulations.

3. The mechanical deficiencies of this technique seem to the writer:

(a) There is not sufficient deposition of bone before six months.

(b) Fusion follows the curve of scoliosis, so that the newly formed bone might yield under the supra-incumbent strain of weight-bearing.

(c) At each vertebra there are five distinct points at which fusion is to be obtained, and if for any reason ossification in any proportion of these five points does not result, there is freedom of motion at this level and the result of the operation is vitiated to a large extent. As a matter of fact, whether or not it was due to faulty technique on the part of the operator, the writer found in a majority of cases operated on by this technique on the Second Division at the Hospital for Ruptured and Crippled, New York, that there was motion demonstrable on the vertical fluoroscopic screen in the fused area.

The technique of Mackenzie Forbes[1] consists of splitting the spinous processes and interdigitating the fragments to more nearly approach a continuous extent of bone; otherwise the technique is that of Hibbs.

The use of the osteoperiosteal graft as a substitute for the chips from the laminae, and as an endeavor to obtain an unbroken extent of bone throughout the area of fusion, is an advance of no consequence. This method was first used by the writer in 1921[5]. This technique was later reported by Henry Bascom Thomas[6], and again by Philip Lewin[7]. At this operation also an attempt was made to obtain fusion on the concave side alone, which would be sufficiently strong to hold the curve. Observation of a number of cases operated on by this technique, has convinced the writer that it is without merit.

The use of the beef bone graft, as described by Kleinberg[8] represents another attempt to obtain a continuous extent of bone throughout the fused area. Otherwise his technique does not vary from that of Hibbs, although in the severe cases, of course, it is applied to the concave side alone. This technique involves the sawing out beforehand of a piece of beef bone which will follow the curve of the spine. It has the disadvantage of introducing a foreign body and also consumes considerable time in its application.

The latest technique is that of rib resection and the use of this rib in the place of Kleinberg's beef bone graft, as described by Whitman[9]. By this technique alone, there is obtained reduction of the kyphos formed by the angulation of the ribs on the convex side. In severe irreducible scoliosis, the lung on the convex side does practically the work of both and it seems to the writer that the embarrassment of its function which must be caused by removal of one or more ribs, is a serious matter. If there is added to this embarrassment the fatigue of the operation of spine fusion, it would seem to the writer that the patient might be subject to strain which would constitute a positive danger to life. If the operation is done

FIG. 1

Case operated on by the writer's technique, three years postoperative, showing massive bone deposit on the concave side of the curve.

in two stages, that is, the rib resection at one and the spine fusion later, using the resected rib as a graft at the second stage, the operation will differ very little from Kleinberg's technique mentioned above, inasmuch as it will involve the insertion of dead bone.

The last technique to be mentioned, is that devised by the writer and first used on a case at the Post Graduate Hospital, New York, December 1922. Since this time, this operation has been done in eleven cases at the Hospital for Ruptured and Crippled, New York, and in one case at the Ann May Memorial Hospital, Spring Lake, New Jersey.

The technique consists of reflecting a flap composed of periosteum and interspinous ligaments, as in the Hibbs operation from the spinous processes

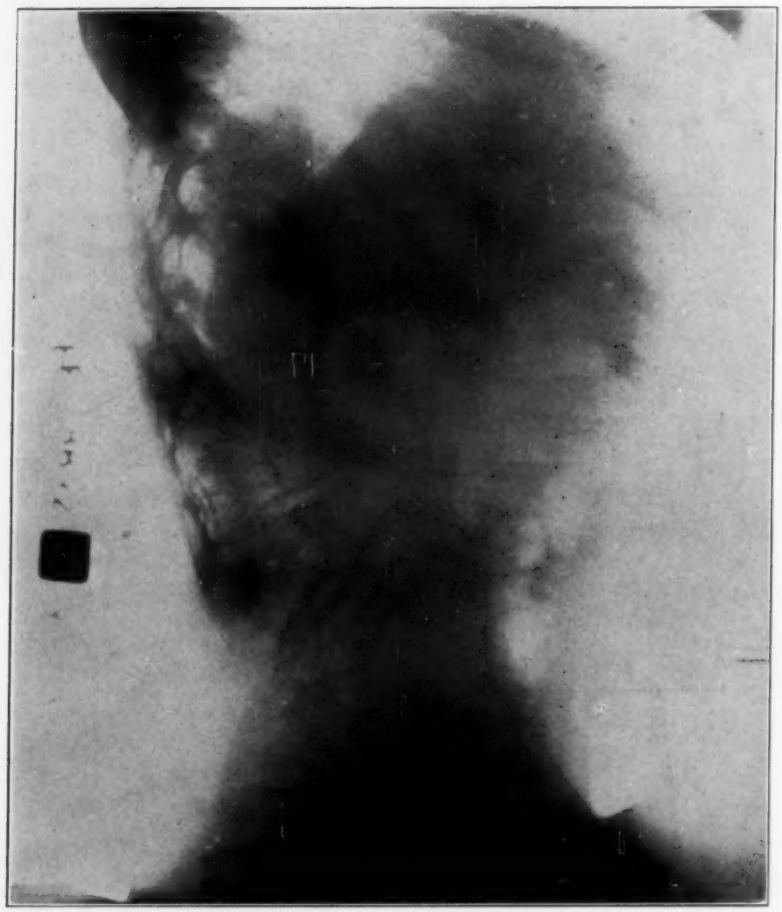

FIG. 2

Showing lateral view of same case, three years postoperative.

and laminae on the concave side. The spinous process at each pole of the incision is cleft and the intervening spinous processes broken down. A straight three-layer graft, of sufficient length to reach from one cleft spinous process to another, is removed from the tibia and inserted as by the Albee technique. The periosteal flap is then sutured around this graft. In this way the graft extends from the beginning to the end of the curve as does a string on a bow. The graft holds the periosteum away from the spine like the ridge-pole of a tent. It also stimulates ossification of the mass of blood and broken bone included by the flap.

The advantages of this technique, it seems to the writer, are the following:

1. The simplicity of technique. The duration of the operation is seldom over forty minutes.

2. The rapidity and profusion of bone production obtained. X-ray taken three months after operation already shows bone laid down at the site of operation, whereas by the other techniques it is unusual to find evidence by x-ray in less than eight months.

3. The efficacy of the support obtained, although applied to the concave side of the curve alone.

4. The fact that from the start there is a strut preventing increase of the curve, lying either in the line of weight-bearing or parallel to it, which cannot yield and allow any increase in the curve of the spine.

The disadvantage, of course, is that an incision in the leg is necessary. In practice, however, patients have not complained of the operative wound in the leg.

The after-care of these cases consists of wearing a well padded jacket, applied at the time of operation, over a period of three months,—six weeks of which is spent in bed in postoperative convalescence.

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FRACTURES OF THE SPINE*

BY FRED R. FAIRCHILD, M.D., F.A.C.S., WOODLAND, CALIF.

From the Department of Surgery, Woodland Clinic

The problems associated with the diagnosis and treatment of fractures in general have been largely solved. The treatment for the various types is approaching standardization. This is not true of vertebral fractures. In spinal fractures three factors complicate the diagnosis. Anatomical conditions frequently make an accurate knowledge of the condition existing impossible, since the classical signs of fracture may all be absent. The complicated structures of the vertebral segments are such that the x-ray film is the register of a compound shadow. The roentgenologist is in danger of error. The intimate relations of the fragments to the spinal cord and to the roots of the peripheral nerves render the interpretation of the cause of the neurological symptoms most difficult.

If the responsibility attendant on diagnosis is great in spinal lesions, what shall we say of treatment. Every broken spine carries with it the possibility of present or future disturbance of the central or peripheral nervous system. It carries with it the possibility of increasing deformity or of a progressive nerve lesion after the patient has been dismissed in an apparently cured condition. It carries with it the probability of continuing and disabling subjective symptoms, though all objective signs may indicate that the surgeon's work has been well done.

Until we understand more definitely than we do the significance of certain neurological signs we will remain in our present unsatisfactory position. Often with all obtainable data before us, we are uncertain. We cannot be sure whether the disturbance which the nervous system is registering is due to an irritation, temporary in character, occurring at the time of the accident, or whether it indicates an irritation that will be permanent. We do not know whether the source of the irritation is surgically correctable or not. In short, we are often unable to interpret the symptoms with sufficient assurance to feel certainly justified in the procedure which we adopt for treatment.

A critical study of the records of the Woodland Clinic was made in the hope that a group review of the data relating to those patients who had suffered fractures of the spine might lead to conclusions of value. A brief summary of the facts thus obtained is at this time submitted. It is with regret that we admit that the conclusions must be classed as suggestive rather than convincing.

The records for the past three years show that forty patients have been

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admitted suffering from vertebral fractures. That this number should have been seen in one small clinic during so short a period substantiates the opinion above expressed, that in all probability the diagnosis is frequently not made. The following table will indicate the outstanding facts in relation to these injuries, and the subdivisions will serve as texts for brief consideration of the points worthy of discussion.

Cause: It is interesting to note that the automobile is, in the rural communities at least, responsible for more than one-half of all of these injuries. Direct violence is recorded as the causative factor in three of the forty fractures, but it is questionable whether more than one of these three was indeed due to direct trauma.

Location: It will be noted that forty-two and one-half per cent. of spinal fractures occur in the cervical segments. Of these seventeen broken necks, the records show that three were due to the patients diving into shallow water and that in all three there was a complete transverse lesion of the cord with death as a result. The eleven dorsal, eight lumbar and four dorsolumbar fractures were in the main due to extreme flexion of the spinal column from forces exerted under various conditions.

Numbers of Segments Involved: Of the forty patients one vertebra only was involved in twenty-one. In all of the others two or more vertebrae were involved. This fact is significant in emphasizing the necessity of being on guard for double lesions. Nor are these multiple fractures always in contiguous segments. In four of our patients there have been fractures in two portions of the spine with one or more normal segments intervening.

Character and Ratio of Nerve Involvement: The body of the vertebra (usually crushing type) alone was involved in forty-two and one-half per

Cause—Auto.—Fall—Direct Violence	*Per cent.*	*Location—Cervical Dorsal—Lumbar*		*Per cent.*	*Single or Multiple*	*Per cent.*	*Character—Body or Lamina*		*Per cent.*	*Symptoms—Local or Neurological*		*Per cent.*	*Treatment—Operation or Immobilization*		*Per cent.*
Auto.	22	55	C.	17	42½	S.	21	52½	B.	17	42½	L. only	18	45	Laminectomy	12	30
Fall	15	37½	D.	11	27½	M.	19	47½	L.	8	20	L.+N.	22	55	Immobilization	18	45
D.V. 2 ?	3	7½	L.	8	20				B.+L.	15	37½				Rest in Bed	10	25
			D.+L.	4	10												

RESULTS

3 or 7½% Complete recovery—no remaining local or neurological symptoms.
20 or 50% Local symptoms only remaining.
9 or 22½% Local and neurological symptoms causing material loss of function.
8 or 20% Died.

cent. of those admitted, the lamina alone in twenty per cent., and a combination of the two in thirty-seven and one-half per cent. The body fractures carried a ratio of thirty-one per cent. nerve involvement, the lamina forty-one per cent., and the combined fractures eighty per cent. Of the eight patients who died six, or seventy-five per cent., had a combination of body and laminal fractures.

It is an interesting observation that but one death followed an injury to the body of a vertebra alone, and one death followed when the lamina only was involved. Neither of these patients represents the ordinary type of vertebral fracture. The former died, not as a direct result of the spinal lesion, but rather from shock to an aged man following a fall of thirty feet. The latter represented the comparatively rare case of a spinal fracture, resulting from direct violence so applied as to crush the vertebral spine into the cord after fracturing both laminae.

To understand why the results of a fracture of the body or of the lamina alone are so rarely fatal, it is necessary to consider the mechanism of these fractures. As shown by the data above given a spinal fracture, except from indirect violence, is unusual. The application of indirect violence generally results in hyperflexion of the spine. This hyperflexion, if carried to the extent of fracture, will either result in lengthening the posterior aspect of the spine or shortening the anterior aspect, or both.

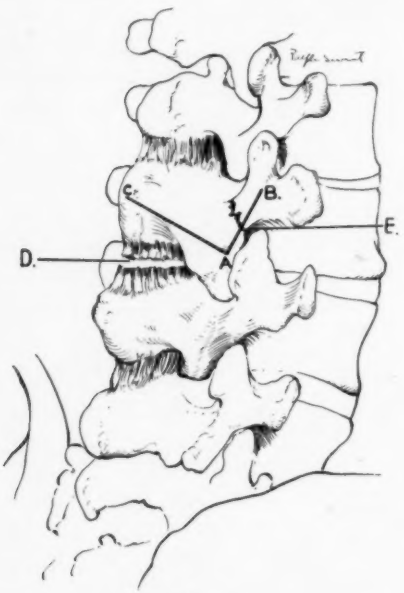

FIG. 1

With rupture of the interspinous muscle and fascia at *D*, the vertebral spine, *AC*, becomes a lever with fulcrum at *A*. The line of stress is through the lamina *AB*. Fracture occurs through the weakest point of the lamina at *E*.

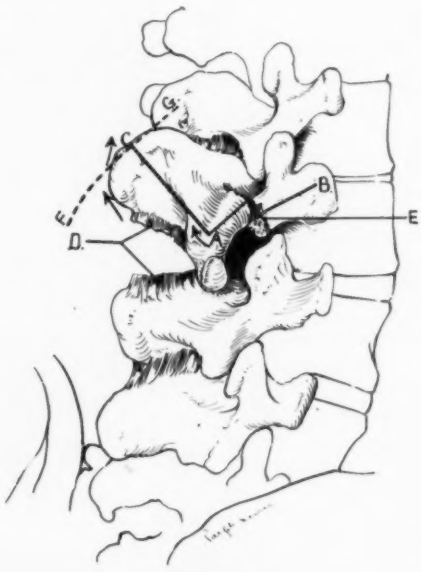

FIG. 2

With separation of the interspinous muscle and fascia at *D*, the line of force carries the vertebral spine, *AC*, upward, its tip describing an arc of a circle. The attached (movable) laminal fragment is thus carried backward and upward away from the spinal cord.

If the posterior aspect represents the point of least resistance the interspinous muscle and fascia will be torn. The vertebral spines of the adjacent vertebra then become levers resisting the force and one or both of these levers may exert sufficient pull on the lamina to which they are attached to cause fracture at these, the weakest points. This force will fortunately lift the laminal fragments out, not press them against the cord, thus tending to preserve its integrity. (See Figs. 1 and 2.)

Should the anterior aspect of the spine represent the point of least resistance, the body of the vertebra will be crushed, the vertebral disc being narrowed in its anterior vertebral dimension. The posterior border of the disc in apposition to the cord may be undisturbed, the cord thus escaping serious injury. (See Fig. 3.)

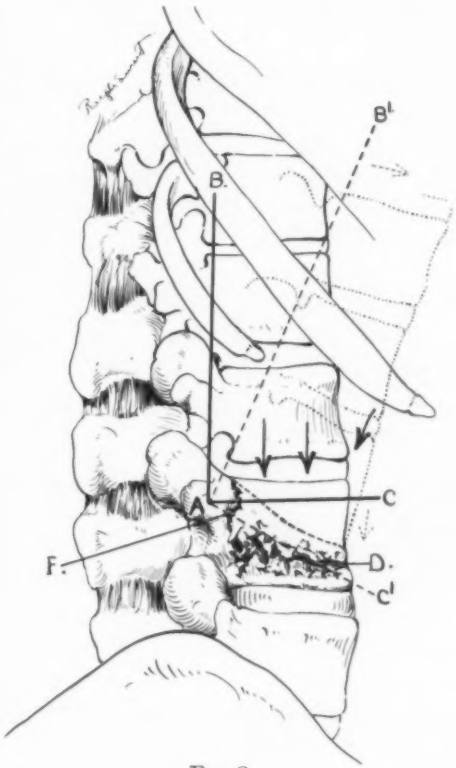

FIG. 3

Where the anterior portion of the vertebra offers the least resistance the spinal column, *AB*, becomes the lever, the vertebral articulation, *A*, the fulcrum, with the vertebral body, *AC*, in the line of stress. The dotted lines represent the post-traumatic position with crushing of the vertebral body with a minimum of disturbance to the spinal canal.

Where both lamina and body are involved, no continuous line of stability remains to protect the cord. Dislocations are commonly seen in these types of fractures, with almost certain disturbance to the diameter of the spinal canal, and serious injury to the cord which it carries.

Treatment: The study of this group of patients was made in the hope that some data might be obtained which would add to our confidence in selecting a method of treatment. Laminectomy was done on twelve, or thirty per cent., of these persons. Eighteen were treated by some method of fixation and ten by rest in bed only. A critical analysis will not be attempted in the series of those treated by conservative means. This method was selected as applicable to those who had no positive evidence of cord lesion nor such trauma to the bone as to excite fear of irritation to the cord subsequently by the formation of callus. Of the ten treated by rest in bed, four had obviously complete transverse lesions and six had laminal or minor fractures of the body. From slowly progressing angulation following dismissal, observed in some of those who had suffered fractures of the vertebral body, we are convinced that the period of support to the

spine after fracture is generally too short or the method of fixation inefficient.

The structures of the vertebral bodies are largely composed of cancellous bone. Our knowledge of the great tendency to progress in angulation, when there has been even a small amount of destruction of one of the discs from tuberculosis, should serve to put us on guard against a similar progressive deformity as an aftermath of fracture. This danger was strongly emphasized in the patient, "A. B.", who, after having had complete operative restoration of function, passed into the hands of other advisors during her later convalescence. The spine was not sufficiently supported, with the result that she has an angulation simulating a far advanced Pott's disease. It is now our rule that no patient who has suffered a fracture, however slight, of the vertebral body shall be permitted to continue in the erect position until a brace has been fitted which will entirely neutralize the tendency to angulation. This brace should be worn always, when the patient is up, for a period of from four to eight months, depending on the severity of the lesion.

A laminectomy was done on twelve of the forty patients, *i.e.*, thirty per cent. The indications for laminectomy in the presence of a vertebral fracture which determined us to operate, were positive evidence of cord irritation with transmission of some impulse demonstrating that there had not been a complete severance of its continuity. These cases can be most clearly discussed by dividing them into three groups.

Group I: In six of the patients at operation there was *no* evidence of intrinsic cord injury. In all there was extra or subdural œdema; in two there was slight subdural hemorrhage and in two there was direct pressure on the dura from bony fragments. The prognosis, if based on the appearance of the cord alone, would have been excellent in all cases for complete recovery.

The results in this group were on the whole disappointing. Notwithstanding the apparently uninjured cord there was complete loss of sexual power in two, loss of bladder and bowel control in three, and great motor deficiency in three. There was but one complete recovery.

The operation was considered not to have been a material factor in such improvement as was made in three of the patients, and was certainly the only material factor in the improvement made in two. There is a question as to the relation of surgery to the improvement made by the sixth patient.

Group II: In three of the patients operated upon there was obvious, but apparently slight, lesion of the cord, yet in all of these the pre-operative neurological evidence suggested all but complete transverse destruction.

Of this group operation certainly had no influence for good in one patient. The second patient in this group enjoyed subsequently a marked improvement, but we cannot conscientiously say that anything was done during the operative procedure to account for this. The third patient regained sixty per cent. of his motor function; has complete bladder and

bowel control and is about comfortably on crutches. Surgery should be given the major part of the credit in this case.

Group III: The remaining three patients in the operation group are those who on inspection of the cord had complete transverse lesions. In all, the pre-operative tests indicated the condition found. There was transmission of no impulse. Laminectomy was undertaken in the hope that we were mistaken in our diagnosis of cord severance or because of the importunities of the family. Our conclusions are that operation on patients in this class are at best meddlesome.

The deduction from the operative cases as a whole would lead to the following conclusions:

1. Every patient who has suffered a fracture of a vertebral body should be fitted with a brace neutralizing any tendency toward angulation. This support should be worn when the patient is ambulatory for from four to ten months, depending on the severity of the lesion.

2. When there is *no* impulse transmitted we may safely assume that there is a complete transverse destruction of the cord. Surgery can accomplish nothing.

3. When *any* impulse is transmitted the benefit of surgery should not be denied. Thirty per cent. of these patients in our series were greatly benefited.

4. If laminectomy is to be undertaken it should be done promptly. Pressure of sharp fragments may transform a temporary cord defect into a permanent cord lesion.

5. The appearance of the spinal cord serves as a poor index in estimating its ability to function. For this reason prognosis based on this evidence should be guarded.

ANALYSIS OF CASES OPERATED UPON

Group I. (Six patients): Includes those in whom there was no evidence that the cord had sustained permanent damage.

H. B. MALE. AGE 35:
Crushing fracture of the body and lamina of the twelfth dorsal.
Except for local pains there were no neurological suggestions of injury except hyperactive reflexes.
At operation the cord showed no evidence of having been injured.
His recovery was complete except that he never regained his sexual power and he had a continuing and annoying burning on the inner aspect of his thighs.
Surgery was not a factor in his improvement.

B. S. FEMALE. AGE 40:
Fracture of the body of the eleventh dorsal with little crushing or evidence of displacement.
Complete flaccid paralysis of the lower extremities.
Tactile sense diminished. Protopathic present.
Reflexes of lower extremities absent.
At operation there were many extradural clots, marked extra and subdural oedema, but no visible cord injury.

There was a return in large measure of sensory function, a return of about ten per cent. in motor function. She regained partial control of her bowels, no control of the bladder.

We do not feel that the operation was a material factor in her improvement.

J. F. S. Male. Age 27:

Crushing of the body of the twelfth dorsal.

Loss of bowel and urinary control.

Other neurological data not complete.

At operation the cord was found to be markedly oedematous but fibers were apparently intact.

This patient regained ninety per cent. of his bowel and urinary control.

He had total loss of sexual power.

We cannot feel that laminectomy was a material factor in his improvement.

M. McC. Female. Age 13:

Shattering of the right side of the body of the fourth and fifth cervicals.

Loss of pain and temperature sense left side of body but tactile sense present. Paralysis, spastic, right arm and left leg.

At operation fragments were found to be pressing on the dura which it was not considered necessary to open.

This patient made a complete recovery except a slight spastic deficiency of the left foot and right hand.

We believe that the operation should be given credit for all of the regained function in this case.

M. G. Female. Age 34:

Crushing injury of the lamina and body of the twelfth dorsal.

Complete loss of bladder and bowel control. Great sensory disturbance and some paralysis of lower extremities. Neurological records not complete.

At operation there was marked oedema and subdural hemorrhage, the clots being sufficient to cause disturbance.

She had an incomplete return of all functions.

Operation was probably a material factor in her improvement.

A. B. Female. Age 28:

Crushing injury twelfth dorsal with dislocation on first lumbar.

Total motor paralysis of lower extremities, perversion of sensory functions and reflexes of lower extremities.

At operation a strong band of fascia was discovered drawn between the twelfth dorsal and first lumbar vertebrae, tightly constricting the cord. There was marked extradural hemorrhage. The constricting fascia was excised. The dura was not opened.

Results were complete return of all motor and sensory functions, but marked angulation at the site of the fracture.

Operation was certainly the only material factor in this patient's recovery.

Group II. (*Three patients*): Includes those patients who at operation had obvious lesions of the cord, which lesions, judging from macroscopical appearance, were slight.

B. G. Female. Age 40:

Comminuted fracture of lamina of first, second and third lumbar vertebrae.

Complete motor paralysis of lower extremities. Protopathic sensibilities present. Heat and cold sense present. Loss of bowel and bladder control. Loss of reflexes.

At operation dura was found to be torn and the cord blue from intrinsic hemorrhage.

This patient had a very incomplete return of function of the right leg.

There was permanent flaccid paralysis of the left leg and a fairly complete return of bowel and bladder control.

There is a question as to the relation of the operation to her improvement.

G. N. MALE. AGE 52:

Fracture of the first, second, third, fourth and fifth lumbar vertebrae with comminution of the lamina of the third, fourth and fifth vertebrae.

Total motor paralysis of the lower extremities with all reflexes lost.

Absence of bladder and bowel control.

Protopathic, epicritic and joint sense present.

At operation there was found to be marked oedema, both extra and subdural, with clots against the cord. Also there were laminal fragments pressing firmly against the dura.

This patient regained bladder and urinary control and about seventy per cent. of his motor control. He is able to be about comfortably on crutches.

We feel that the operation was the material factor in his improvement.

C. R. MALE. AGE 61:

Fracture of the ninth dorsal with laminal depression against cord.

Flaccid paralysis of lower extremities. Loss of all sensory reaction.

Loss of all reflexes and bladder and bowel control.

At operation the lamina of the ninth dorsal was found crushed against the cord.

The dura was opened and at this point the cord appeared narrow and hemorrhagic.

This patient died on the fifth day, probably from other injuries than that related to the cord.

Do not believe that the operation would have resulted in any improvement.

TREATMENT OF MILD SCOLIOSIS BY DEVELOPING THE MUSCULATURE OF THE TRUNK

BY CHARLES LYLE HAWK, M.D., IOWA CITY, IOWA

It has been the privilege of the writer to supervise the physical examinations of the men students entering the State University of Iowa, and to direct corrective classes for those requiring corrective exercises. Out of a group of 2,100 students, one and nine-tenths per cent. presented a degree of mild scoliosis sufficient to necessitate their transference to corrective classes for treatment. It is the treatment of this form of mild scoliosis that I wish to present.

Mild scoliosis seen in the adult can usually be traced to occupational or postural origin, the onset appearing after the growth of the individual has been attained. In reading the literature one can quickly pick up a dozen or more causes attributed to scoliosis, but most of these occur during childhood or before the growing period has been completed, and are accompanied by alterations in the bony structure. But a lateral curvature developing from a faulty posture with normal bony structure after the age of puberty seldom becomes progressively worse and is ameliorable to treatment by proper exercises and postural habits. Unless it is of long duration it may be assumed that no bony changes have taken place,—only a maladjustment of the cartilaginous intervertebral discs and a shortening of the musculature of one side of the trunk and a lengthening of that on the opposite. The rotation of the vertebrae will be accompanied by a posterior prominence of the ribs on the convex side and a depression of those on the concave side.

The question arises, "Why do the vertebrae rotate?" We will first consider the articular processes. Looking at the spine from behind in the cervical and dorsal regions, the articular processes of the vertebra above lap over those of the one below like the shingles on the roof of a house, only the planes of these articular surfaces on either side of the vertebra, instead of being coincident at 180 degrees, intersect posteriorly at an angle of about 130 degrees. Between the eleventh and twelfth thoracic the two planes coincide at 180 degrees; between the twelfth thoracic and first lumbar the planes meet at about forty-five degrees, but their point of meeting is anterior instead of posterior to the articulations. The remainder of the lumbar articulations are almost in parallel planes anteroposteriorly. Between the fifth lumbar and the sacrum the planes may be parallel, as the interlumbar, or there may be an anterior angulation which increases in the lower lumbars until we find the fifth lumbar and sacrum articulating at an angle of as much as one hundred and five degrees. In the former condition, spondylolisthesis is prone to occur. It will be seen

readily that the intervertebral articulations play no part in scoliosis for the latter appears not to be influenced in the least by the variation of these planes.

We will next consider the shape and size of the vertebrae themselves. The width of the bodies in the cervical region varies from 2 to 3.25 cm.; in the dorsal from 3 to 4.5 cm.; while the lumbar are from 4.5 to 5 cm. The length of the vertebrae measuring from the tips of the spines to the *centers* of the bodies is 3 to 5.5 cm. in the cervical; 4.75 to 5.25 cm. in the thoracic; and from 5.5 to 6 cm. in the lumbar spine. The reason for measuring from the tips of the spines to the centers of the bodies is because the line of fulcrum in marked lateral bending passes from the tips of the spines to the sides of the bodies at a point slightly posterior to a line passing laterally through their centers. That is, in a left-sided convexity of the spine the vertebrae must rotate counter-clockwise, and, if the scoliosis reaches a degree where the intervertebral discs are compressed to their limits, then to allow any more lateral bending the vertebrae must rotate until the fulcrum line passes from the tip of the spine to the side of the body of the vertebra. That is, the fulcrum coincides with the side of an isosceles triangle whose base is approximately one-half the width of the body and whose sides pass from its apex at the tip of the spine to the center and side of the body respectively. The apex of this triangle is the greatest angle of rotation which the vertebrae can undergo *unless bony changes take place.*

The attachments of the ribs serve as levers to indicate the degree of rotation. In the adult the most posterior portion of the ribs averages from 8 to 9 cm. lateral to the spinous processes on either side. Now for example, if a case shows a prominence of the ribs of the left side, which, when leaning forward, rise, say, one inch, or 2.5 cm. above the level of those on the opposite side, and the posterior prominence of the ribs is 8.5 cm. from the spinous processes, then the amount of rotation of the vertebra would be computed by the formula:

$$\sin \frac{\alpha}{2} = \frac{\frac{2.5}{2}}{17} = 0.0735$$

$$\frac{\alpha}{2} = 4^\circ\, 47'$$

$$\alpha = 9^\circ\, 34'$$

To compute the maximum rotation which the vertebrae can possibly make, let us take an average thoracic vertebra which would be 3.8 cm. in width at the body and 5 cm. in length from the tip of the spinous process to the center of the body. From the sagittal plane to the fulcrum line in the maximum rotation, we have an isosceles triangle made up of two

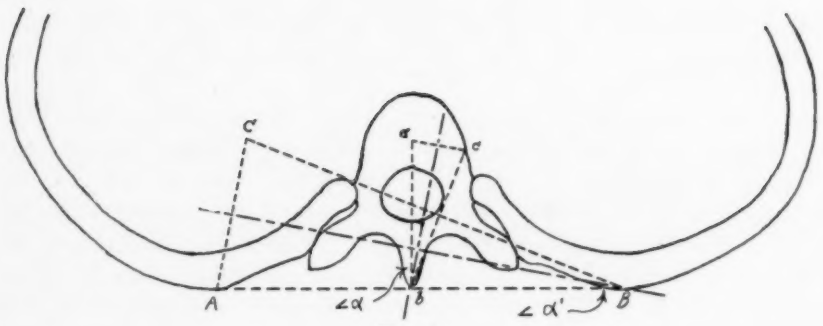

FIG. 1

right-angled triangles the hypotenuses of which lie in the sagittal plane and fulcrum line respectively, and the lengths of which are equal to the distance from the tip of the spinous process to the center of the vertebral body. The base of this isosceles triangle is composed of approximately one-half the width of the body. The apex of this triangle represents the maximum rotation the vertebra can make *without the presence of bony changes.*

By referring to Figure 1 it is evident that triangle a, b, c, is similar to triangle A, B, C, hence the angle α is equal to α' the value of which is computed by the formula:

$$sin\ \frac{\alpha}{2} = \frac{\frac{1.9}{2}}{5} = 0.19$$

$$\frac{\alpha}{2} = 10^\circ\ 57'$$

$$\therefore \alpha = 21^\circ\ 54'$$

Since sine alpha over two times the hypotenuse equals the altitude, or half the posterior projection of one side of the chest over the opposite side, by measuring the asymmetry of the posterior chest, one is able to determine the amount of rotation of the spine in that region. It is, therefore, obvious that in mild scoliosis where there is but a slight amount of asymmetry of the posterior costal prominence, the degree of actual vertebral rotation is small and corrects itself on straightening of the spine, so that in the treatment of the same, the rotation may be disregarded with impunity.

THE METHOD OF TREATMENT ADOPTED

The principle outlined and carried out is to develop the musculature of the trunk on the side of the convexity, the object being to cause greater strength and muscle tonicity on this side of the chest and abdomen which

FIG. 2

Showing method of treatment for scoliosis. The student lies on a padded bench with the convexity of the spine upward. By lifting his head and shoulders with the feet fixed the muscles on the upper aspect of the trunk are developed.

would increase the downward pull of the shoulder girdle and gradually bring the spine into permanent alignment. No attempt whatever is made to "loosen up" the spine, nor is the practice of having the student hang from a ladder by the arm on the side of the concavity tolerated, since this latter practice would defeat the purpose by developing the musculature of the concave side, which, by its tonicity, would increase the lateral curvature.

As Figure 2 shows, the student lies on a padded table with the convex curvature of the spine upward and, with the feet held in position, the weight of the entire head, arms, shoulders and chest is raised and lowered, thereby exercising the musculature of the upper side of the entire trunk. It is essential that considerable resistance be employed in the exercise of these muscles as the trophic stimulus to a muscle is not greater than the demands placed upon it. Only a certain degree of fatigue, however, must be allowed, but the author has found that in corrective work of any kind there is very little danger of the individual exerting himself to the point of overfatigue.

The photographs shown (Figs. 3-A — 6-B) were cases which had only two hours of corrective exercise per week for a period of about eight months. They all show a slight degree of correction which would have been much greater were five or six hours per week spent at the work. In fact to get optimum results the author would recommend one hour's work each half day for six days per week.

The student is also instructed to form the habit of standing on one foot,—the foot on the side of the convexity, and also, when carrying a

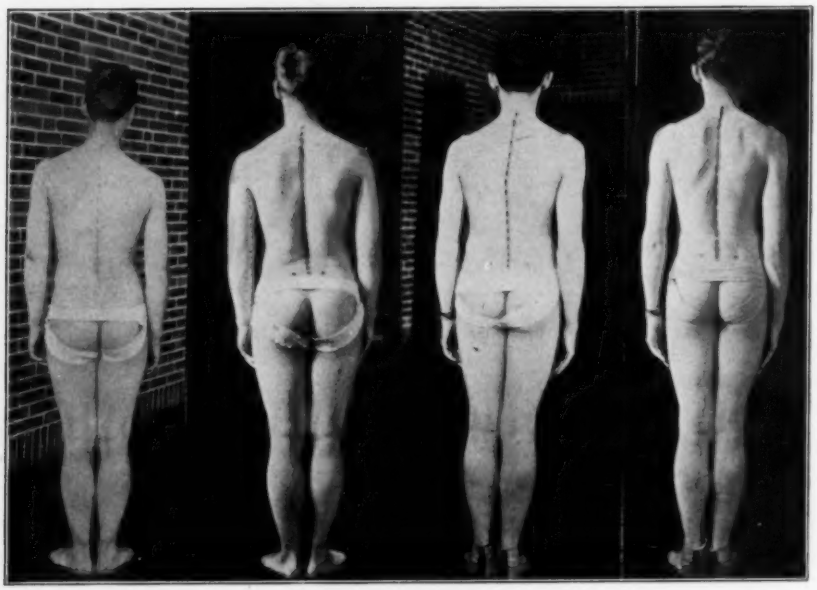

FIG. 3-A
Before Treatment

FIG. 3-B
After Treatment

FIG. 4-A
Before Treatment

FIG. 4-B
After Treatment

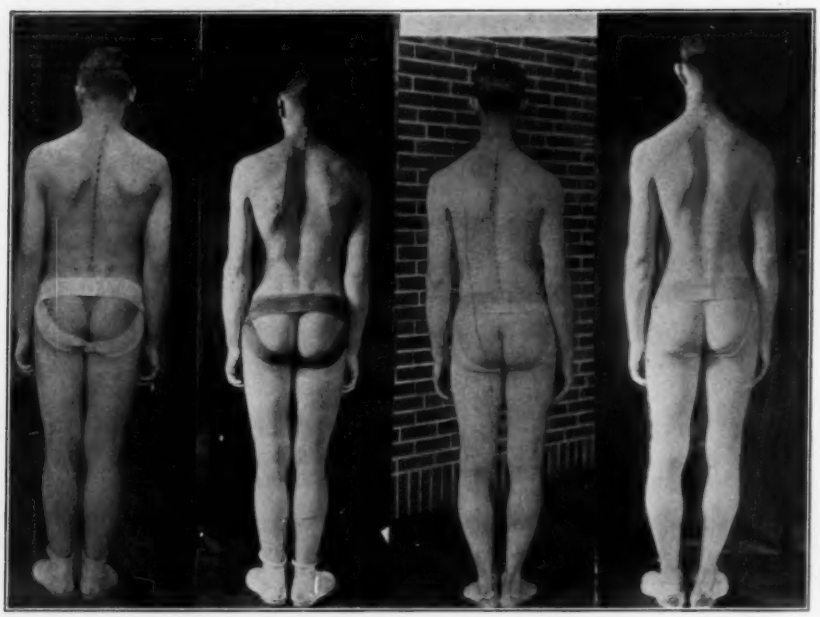

FIG. 5-A
Before Treatment

FIG. 5-B
After Treatment

FIG. 6-A
Before Treatment

FIG. 6-B
After Treatment

weight, such as a sack of books, to carry it in the hand on the side of the concavity, because the shoulder girdle thus puts into action the muscles of the opposite, or convex, side of the trunk.

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TRACTION FRACTURE OF THE SMALL TROCHANTER OF THE FEMUR; WITH A REPORT OF AN APPARENTLY RECURRENT CASE

BY HAMILTON BAILEY, F.R.C.S., BIRMINGHAM, ENGLAND

Surgeon, Dudley Road Hospital, Birmingham. Gillson Scholar, Society of Apothecaries

Traction fracture of the small trochanter is rare. There are but twenty-five cases recorded in the medical literature (Scudder). The writer has recently been enabled to observe a case of this condition which presented much difficulty in diagnosis.

B. G., aged thirteen, whilst running, was seized with a sudden agonizing pain in the left thigh. He was unable to reach home without aid. Next morning he was taken to a hospital, examined and x-rayed (screen), but nothing abnormal was found.

FIG. 1

X-ray showing the avulsion of the small trochanter. The appearance of the fragment suggests that it is a separated epiphysis.

He went home and to bed. On the following day the pain was so intense that he was transferred to the hospital in an ambulance. The lad, a red-faced country boy, as he lay in bed when first observed, was smiling. He described the attack, and stated that when seven years of age, he had had an exactly similar attack of pain.

On examination there was nothing abnormal to be seen. He pointed to the anterior surface of the left thigh as the site of the pain, and also to the left loin. The skin of the thigh was tested for hyperaesthesia. The thigh was palpated, and the hip joint rotated, all without eliciting the slightest abnormality. The girth of the thighs was the same, and an abdominal examination revealed nothing. The patient was then asked to sit up, in order that the loin might be examined. When he had almost reached the upright sitting posture, he gave a piercing shriek, his face became livid, he turned upon his left side, and literally writhed with pain. A few minutes later all the signs of pain had gone, but on asking him to sit up again, the paroxysm was again observed. The temperature and pulse were normal.

The diagnosis was obscure and the notes state: question of partial rupture of the quadriceps, but no signs; question of anomalous renal colic. It was not until an x-ray of the hip joint was taken that the diagnosis was clear (Fig. 1).

FIG. 2

Ludloff's sign of fracture of the small trochanter. Whilst the patient sits he is unable to lift the affected leg. This photograph was taken four days after the accident and the patient is just able to tremulously move the leg in the sitting posture but cannot get the foot off the bed.

Forty-eight hours later the pain had abated, and the patient was able to sit up. Ludloff's sign of fracture of the lesser trochanter,—to wit, inability to raise the thigh when in a sitting posture,—was clearly demonstrable (Fig. 2).

In view of the fact that the patient had had an exactly similar attack of pain six years previously, it was assumed that union by fibrous tissue had occurred in the first instance, and that this had ruptured at the time of the second avulsion.

According to Ruhl, nearly eighty per cent. of cases of traction fracture of the lesser trochanter occur between the ages of ten and twenty. It therefore seems that this lesion must often be a separation of the epiphysis which joins the shaft between the eighteenth and twentieth years. The x-ray appearances of the detached fragment leave little doubt that, in this case, an avulsion of the epiphysis had occurred.

Ruhl states that the best method to examine the small trochanter is to palpate deeply towards the inner third of the gluteal fold between the adductor and flexor groups of muscles. Although this was not tried in this case, it should be borne in mind for future physical examination. Scudder emphasizes that there is tenderness to be found in Scarpa's triangle; the author can state quite definitely that in his case there was not the slightest tenderness in this region.

FIG. 3

A recent x-ray showing end result of traction fracture of the lesser trochanter.

To fix the trochanter onto the shaft by means of a bone screw appeared an attractive proposition, but before attempting it Poston's article was consulted. Poston's case was completely cured by fixing the limb in flexion and abduction. The hip joint was, therefore, put up into flexion and abduction for fourteen days, when massage was commenced. The patient regained perfect function of the limb.

An x-ray two months after the accident shows the small trochanter joined to the shaft at a slightly higher level than normal and with a considerable amount of callus formation.

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AVULSION OF THE LESSER FEMORAL TROCHANTER

BY PHILIP LEWIN, M.D., CHICAGO

Associate Professor of Orthopaedic Surgery,
Northwestern University Medical School

The following is a report of a case of an injury to the lesser femoral trochanter which became loosened from its attachment. Then a sudden muscular effort pulled it off. Certain diagnostic and therapeutic features are illustrated by this patient.

L. M., white boy of fourteen years, referred by Dr. H. Salzman, was first seen by the writer November 26, 1926. While playing football he was tackled in the region of the left hip which caused considerable pain, but he continued to play. Several minutes later he attempted to tackle another player, but was forced to "stop short" before reaching his opponent. He felt severe pain in the left groin and found he was unable to use his left leg properly. Examination revealed the signs described below. Roentgenograms made by Dr. M. I. Kaplan revealed avulsion of the lesser trochanter. See Figure 1.

He entered St. Luke's Hospital and was put to bed in a sitting posture with the affected leg adducted. This position was maintained during the day and night. A single spica cast was applied maintaining flexion of the thigh, adduction past the midline, and slight internal rotation (Fig. 4). Crutches were fitted and he left the hospital December 1. On December 21 the cast was removed. He was able to flex his thigh very well. A spica cast was applied, holding his leg almost extended. This was removed January 12, 1927, and examination two days later revealed very good function of the iliopsoas muscle. He was advised to continue the use of crutches, to apply a two-inch

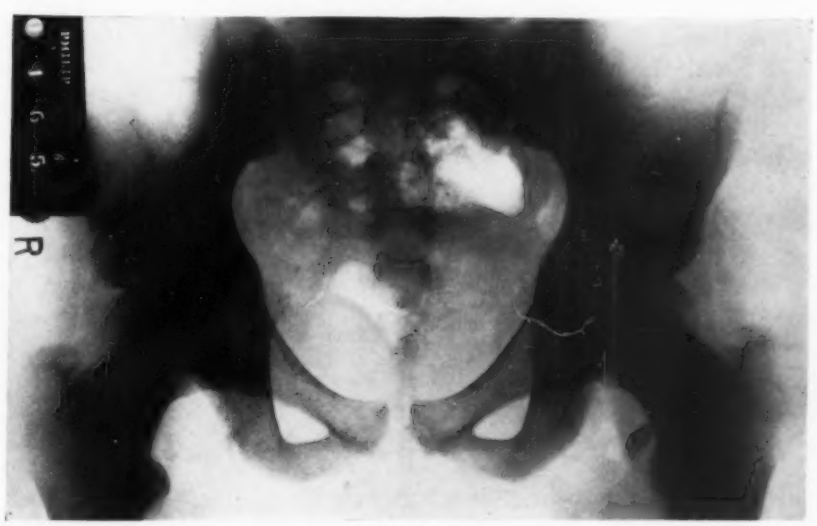

FIG. 1

Roentgenogram showing avulsion of left lesser trochanter.

FIG. 2
Roentgenogram made nine months after accident.

cork lift to the sole and heel of the right shoe, and to present himself for phototherapy, massage, and gentle active and passive exercises. On January 22, eight weeks from the time of accident, his function was excellent, and one week later all leg tests were normal.

There have been about forty-four cases of avulsion of the lesser femoral trochanter reported in the literature. The similarity of the histories and the ages of the patients is noteworthy. The diagnostic features and the excellent prognosis under appropriate treatment are the reasons for recording another case.

Practically all the cases have occurred between the twelfth and sixteenth years. Boys predominate, because of greater subjection to trauma. The etiology is always injury, either direct or by muscular pull.

The anatomy of this region, briefly, is as follows: The psoas major muscle arises from the lateral surfaces of the bodies and intervertebral discs of the vertebrae from the twelfth thoracic to the fifth lumbar, as well as from the transverse processes of the lumbar vertebrae. The fibers converge downward, forward, and lateralward, and are inserted by means of a narrow tendon into the lesser trochanter of the femur. The action of this muscle is to bend the lumbar spine lateralward, to flex the thigh and rotate it outward somewhat. When the thigh is fixed, it bends the pelvis and the body forward (Fig. 3). The iliacus muscle fibers run in common with those of the psoas major to the lesser trochanter. This muscle also flexes the thigh and rotates it outward, and when the thigh is fixed, it draws the pelvis and body forward.

Parsons divides epiphyses into three types: pressure, traction, and atavistic. The lesser trochanter is an example of a traction epiphysis. The ossification center of the lesser trochanter appears at about the twelfth

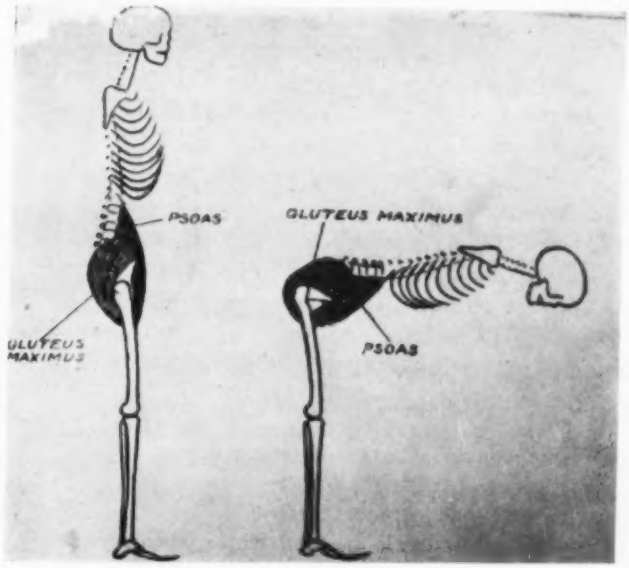

FIG. 3

Action of iliopsoas muscle, standing and bending forward. (Mackenzie.)

year, and unites with the shaft at about the eighteenth year. It is a comparatively weak structure to withstand so considerable a leverage force as it is subjected to. It is not surprising, therefore, that it is occasionally avulsed.

The symptoms of avulsion are those of disturbed function of the iliopsoas, *viz.*, limp due to inability to flex the leg, and pain and tenderness in the region of the lesser trochanter. Two signs which the writer wishes to describe are brought out by the following: The patient sits on a table with both legs hanging over the side. He is instructed to raise his well leg and place his heel on the table. He then attempts the same movement on the affected side but fails. The second sign is brought out by having the patient stand squarely on both feet with knees extended. He is directed to bend from the hips and pick up an object from the floor, which he is unable to do.

Ludloff's sign is considered pathognomonic. With the patient in the recumbent position, partial flexion of the extended limb may be possible, due to the action of the tensor fasciae latae and the rectus femoris, but when in the sitting position this movement cannot be performed. (Balensweig.)

Roentgenograms reveal the separation and upward displacement of the epiphysis of the lesser trochanter. In order to demonstrate this condition to advantage, the thigh should be extended, abducted, and rotated outward. The rays should be directed straight down from above, and both sides shown on the same film (Fig. 1). After the films have been made, the affected limb should never be allowed to assume the extended position until cured.

The conditions about the hip which must be differentiated are fracture, dislocation, epiphysitis, septic arthritis, and epiphyseal coxa vara. The prognosis is uniformly very good. The course is from six to ten weeks. The treatment is based upon simple principles of anatomy, mechanics, and orthopaedic surgery.

In contradistinction to the usual practice of enforcing absolute bed treatment in the normal supine position which puts tension upon the psoas muscle, the patient should sit in bed with the back rest and pillow holding him in the position of sitting upright, with the affected thigh adducted. This position may be modified for sleep by reducing the hip flexion somewhat, *i.e.*, using the back rest at an angle of forty-five degrees, and one pillow. As soon as possible the patient is put on his back on the Hawley, Albee, McKenna, or Oppenheimer table and a single spica of the hip applied, maintaining him in a position of sitting with the affected thigh adducted so that the knee passes the mid-line of the body. The thigh should be rotated slightly inward (Fig. 4). In this position sitting is comfortable and walking with the aid of crutches is possible. A wheel chair should be procured. "Scratchers" should be inserted under the cast to maintain

FIG. 4

Plaster-of-paris spica cast maintaining position of flexion adduction and inward rotation of left thigh.

FIG. 5

Second spica cast maintaining position midway between that of Fig. 4 and normal extension.

proper skin hygiene. At the end of three weeks a second spica cast is applied maintaining the extremity in a position midway between the original and the normal extended position (Fig. 5). After another period of three weeks, this cast is bivalved and straps and buckles are applied. Once or twice daily the limb should be massaged and put through gentle passive and active movements. At the end of another week the patient should be up on crutches without his cast, bearing some weight. After two or three weeks the crutches should be discarded, so that ten weeks from the time of injury he should be walking unaided.

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INTERSCAPULO-THORACIC RESECTION FOR MALIGNANT TUMORS OF THE SHOULDER JOINT REGION*

BY BORIS E. LINBERG, M.D., SMOLENSK, RUSSIA

Professor of Surgery, University Medical School

One of the most mutilating operations is the interscapulo-thoracic or Berger's amputation, performed almost exclusively for malignant tumors of the shoulder girdle, chiefly sarcomas. The tumors for which such an operation is done are less frequently local carcinomas and in rare instances traumatic or inflammatory lesions. Statistics show that, when performed by the original Berger method, it gives a minimum percentage of post-operative mortality. But we must acknowledge the fact that the late results of this operation performed for malignant tumors are seldom favorable, and the mortality is high. The study of records indicates about seventy per cent. of unsuccessful results. Conservative operations, as the disarticulation of the humerus, the removal of the scapula together with the head of the humerus, and others, have not been successful. Such an operation, especially with the saving of the limb, is necessitated by the patient's refusing to be operated on in the early stage.

A conservative operation must fulfill the same requirements as the radical one, and may be applied only if the results are better or at least equivalent. In the shoulder region the interscapulo-thoracic amputation is a limited one and its late results have been unfavorable. Therefore in working out the present procedure, the main purpose has been an improvement of end results. This, of course, can be attained only by persuading the patients to consent to early operation. The sarcomas frequently are found in the shoulder girdle region, and have a tendency to invade tissue from which they arise, spreading to the connective tissues, chiefly of the intermuscular layers. Arising from the bones of the shoulder girdle, these tumors easily spread over all parts of the shoulder and its joints, as well as over the lymphatic glands of the axilla. Therefore all parts of the shoulder girdle have to be removed, together with the adjacent structures. In addition to the interscapulo-thoracic amputation, there is the conservative operation offered by Tikhoff† which was described in 1922 under the name of "resectio interscapulo-thoracica". The principle of this method lies in dissecting out the vessel nerve bundle, stripping it from the surrounding tissue and lymphatic glands in the affected portion, and preserving the

*Read before the ninteenth All-Russian Congress of Surgeons, Leningrad, 1927.

†This kind of operation was first performed in the clinic of Professor Tikhoff at the Tomsk University, for sarcoma of the upper quarter of the humerus. The case was traced for a month only and the function was small.

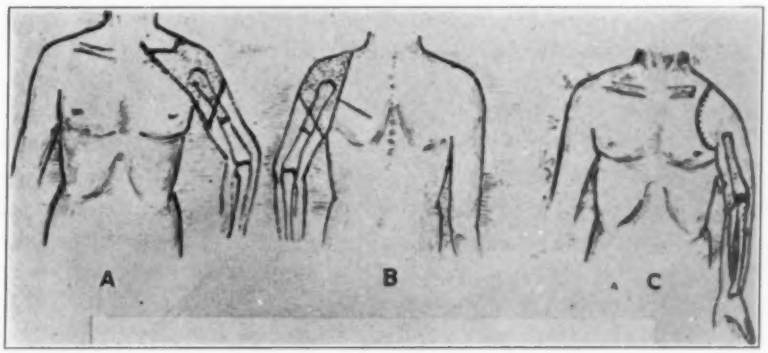

FIG. 1

A. Showing the skin incision anteriorly. *B*. Showing the skin incision posteriorly. *C*. The skin suture after the operation.

healthy peripheral part of the limb. Consequently, the prerequisite for this operation in all cases is a vessel nerve bundle free from the new growth. In tumors of the upper part of the shoulder the affected part of the bone is removed, together with the adjacent soft tissues. The scapula with the muscles connecting the shoulder, and the lateral part of the clavicle are also removed. The remaining part of the extremity may be left without danger of recurrence. In tumors of the scapula, it is the practice of the author to remove this structure with all the adjacent muscles up to the spine and shoulder, a part of the humerus up to the junction with the scapular muscles, and a portion of the clavicle. In tumors of the clavicle, the growth and also the joint ends of the bones of the shoulder girdle are removed.

The technique of this operation developed by the writer is as follows: The patient is laid on the back near the edge of the table with the arm drawn aside. An anterior incision, as for the Berger operation, is started above the middle third of the clavicle, going downwards and outwards to the anterior edge of the arm pit. It then passes along the medial border of the biceps muscle to the marked point (Fig. 1). The clavicle is divided and also the great and small pectoral muscles; the vessel nerve bundle is then dissected out down to the end of the skin incision. The side branches of the vessels are ligated, the nerve branches are conserved where possible. Then on the marked place (Fig. 1-A), a circular flap incision is performed, entering the skin and soft tissues to the bone, the latter being sawed. At times, when there are no glands in the axilla, it will be possible to conserve a strip of skin beneath the vessel nerve bundle, which may be very useful in closing the wound.

The second incision (Fig. 1-B) starts at the clavicle anteriorly and continues over the scapula according to the size of tumor, until both incisions meet. The removed superior part of the limb is extended backwards by the clavicle and shoulder and the scapula is separated from the underlying

tissues up to the scapulospinal muscles, which are cut through from the inside. The part being removed is segregated by separating the skin from the anterior surface of the scapula. The remaining part of the extremity is raised upwards; at the same time the vessel nerve bundle is folded into a sloping fold on the front exterior surface of the breast; the limb is then fixed to the exterior surface of the thorax, while the anterior biceps muscle is fixed by a silk mattress suture to the intercostal muscles, grasping as well the periosteum of the ribs. In cases of tumor of the scapula (Case 2), it is possible to unite the long head of the biceps to the stump of the large pectoral muscle. The innervation of both muscles is preserved and, on bending the forearm, a coordinated contraction is developed. The triceps muscle is also sutured to the intercostal muscles behind (Fig. 1-C). The radial pulse should be watched. Drainage tubes are introduced through special incisions to prevent hematoma.

In the first case and especially in the second case, the writer succeeded in obtaining quite satisfactory function of the arm. The patient in the second case could easily lift sixteen kilograms with the operated arm, bending it at the elbow to a right angle. Although the absence of the shoulder articulation would seem to deprive the extremity of movement to an extended degree, not only in the region of the shoulder but also of the forearm, nevertheless experience proves that the fixing of the upper end of the resected muscles, when their innervation and nutrition are intact, helps to conserve the greater part of its functions. Nearly all movements of the upper extremity except the raising and everting of the humerus are possible.

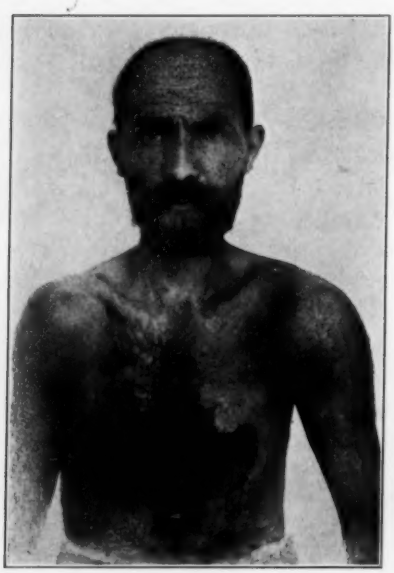

FIG. 2

Case 1. Showing the tumor of the left shoulder before operation.

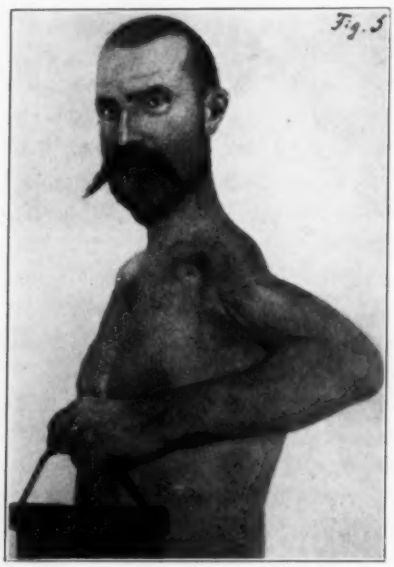

FIG. 3

Case 1. Showing the left shoulder five months after the operation.

Full contraction at the elbow joint with all manipulations of the hand and wrist are possible. In working out this operation it seemed that it would be necessary to suspend the limb by the use of fibrous tissue to the stump of the clavicle or rib, but practice showed that there is no need of this. Owing to continued functions of the extremity, a fibrous capsule forms itself, somewhat like a joint capsule. The amount of humerus removed is an important factor, for in the first case, when one-half of the humerus had been removed, the patient could lift only four kilograms with the arm bent. In the second case, where only eight centimeters had been removed he could lift sixteen kilograms. The first man, a locksmith, continued his usual work for about six months, at which time metastases developed. The second man since his operation has been engaged as porter at the clinic for two years and has been doing well.

The prognosis in such cases depends upon the character and size of the malignant tumor. It is more grave in tumors giving early metastases and growing rapidly through deep tissues; round-celled or fusocellular periosteal sarcomas are so inclined, also carcinomas involving the axilla. It is more favorable in fibrosarcomas and other less rapidly growing tumors. It is

FIG. 4

Case 2. *A*. Showing the anterior aspect of the tumor before operation. *P*. Showing the posterior aspect of the same tumor.

FIG. 5

Case 2. The aspect of the shoulder two and one-half years after operation.

quite obvious that the stage of the morbid process and the size of the tumor are of paramount importance in prognosis, which is better the earlier the operation is performed.

Up to the present the writer has operated on and followed up three cases, a brief report of which follows:

CASE 1. L. B., a man aged forty-three, was admitted to the clinic with a tumor of the upper part of the shoulder of about six months' duration. The growth had apparently invaded the shoulder joint articulation and the intramuscular layers. The vessel nerve bundle was uninvolved. A diagnosis of sarcoma was made and an interscapulo-thoracic resection was performed (Figs. 2 and 3).

The arm was functioning for six months, at which time metastases to lungs and spine developed which caused death of the patient within two months.

CASE 2. D. B., a man aged twenty-two, was admitted with the complaints of swelling in the region of the scapula and of pain in the right hand, of six months' duration (Fig. 4). For two to three months before admission the tumor grew rather rapidly. The patient was well developed and well nourished. General physical and laboratory examinations were normal. On the right side along the lateral border of the scapula was a large oval-shaped tumor which was smooth, adherent to the scapula, moving with the latter. The external edge of the tumor reached the anterior axillary line, where a group of about ten firm glands could be felt. There was some difficulty in raising the arm beyond the horizontal. The diagnosis was a sarcoma of the scapula.

June 3, 1925, an interscapulo-thoracic resection was performed under general anaesthesia, according to the method described above. The vessel nerve bundle was carefully separated up to the supraclavicular region. The upper eight centimeters of the humerus was amputated, taking off a cuff of periosteum from the remaining end. The scapula, one-third of the clavicle, with the adjacent muscles and tumor, were removed. The long head of the biceps muscle was sutured to the great pectoral muscle and partly fixed to the intercostal muscles; the triceps muscle was sutured to the intercostal muscles and periosteum of the ribs. Skin sutures and draining tubes were placed. The operation lasted sixty-five minutes.

The drainage tubes were withdrawn four days later. The general condition of the patient remained good and he was soon up and around. June 11, 1925, the sutures were removed. Primary healing was good. June 25, 1925, the patient left the clinic. In September he was engaged as porter at the clinic, where he is still working at the present time (September 1927).

Gross description of the tumor: The tumor was firm and had a sarcomatous appearance. It originated from the outer margin of the scapula, infiltrating the muscles of the shoulder. Microscopic examination showed a very cellular fibrosarcoma infiltrating the adherent capsule. Two years later, in May, 1927, this patient was demonstrated before the All-Russian Congress of Surgeons (Fig. 5). He was fairly strong, being able to lift sixteen kilograms with the operated hand, bending the arm at a right angle. He also could move his forearm backwards. Strength in the hand was normal and there were no signs of metastasis or local recurrence.

The interval of health of two years' duration is of importance since it would seem to be a guarantee against recurrence or metastases. These usually take place in the first, and seldom in the second year.

CASE 3. A woman, aged sixty, was operated on for a tumor of the scapula (Fig. 6). During the operation the inoperability of the case was obvious, as the tumor had penetrated the chest wall. It was apparent that amputation could not improve essentially the condition and a resection method was used. The patient was treated later with x-rays.

The first case has justified the opinion of the writer expressed five years ago, to the effect that this method is preferable in cases of tumors of

FIG. 6

Case 3. *A*. Showing the scapular tumor before the operation. *B*. After the operation.

the shoulders when the patient refuses to submit to an amputation. The second case demonstrates the fact that cases taken in the early stage of the disease, that is, when the vessel nerve bundle is yet intact, can be operated on according to the resection method.

The third case is presented only to indicate the possibility of performing this operation in old age, the technique of it being more complicated than in cases of amputation.

CONCLUSION

The interscapulo-thoracic amputation of the shoulder is indicated in all malignant tumors of the shoulder girdle where infiltration of the vessel nerve bundle has not occurred. The saving of an arm enables the surgeon to persuade the patient to submit to this operation at an earlier stage, thus greatly improving the late results.

CONGENITAL ABSENCE OF THE PECTORAL MUSCLES
Case Report

BY FREDERICK CHRISTOPHER, M.D., F.A.C.S., WINNETKA, ILLINOIS

Associate in Surgery, Northwestern University Medical School, Attending Surgeon Evanston Hospital

Partial or complete absence of the pectoral muscles is not infrequent. In 1902 Bing[1] collected a series of cases of congenital absence of muscles and found that loss of pectoralis major and minor together constituted the commonest abnormality, twenty-eight per cent. of the total. The absence of the pars sternocostalis of the pectoralis major alone was next in frequency, being nine per cent. Jones[2], in his excellent paper, states that he believes these percentages to be too high as the absence of pectoral muscles is such a conspicuous defect that it is more frequently recognized than lesser muscular anomalies. Recent reports of absence of both pectoralis major and minor are those of—Severn[3], Jones[2], and Heyde[4].

Absence of the pectoralis minor unaccompanied by defects of the pectoralis major probably does not occur. Heredity does not play a strong factor, but in at least two cases (the author's and that of Jean and Solcard[6]) syndactylism was present.

The disability in absence of the pectoral muscles is extremely slight. Burke's[7] patient had this abnormality on the left side, and was a good left-handed pitcher. In Jones's case, the arm on the affected side was stronger than on the normal side.

Lewis[8] believes that the embryological cause was either a failure of attachment and subsequent atrophy of pectoralis minor and pars sternocostalis of the pectoralis major, or a lack of complete differentiation between the two muscles.

CASE REPORT

Patient, J. B., age five and one-half years, was brought to the writer for syndactylism. There was a web between the index and middle fingers, which extended to the proximal interphalangeal articulation and small web between the middle and ring fingers. The larger web was successfully treated by the Didot plastic operation.

In the course of the examination it was discovered that the child had a *complete absence of right pectoralis major and minor muscles* on the right side. This was made particularly apparent when the child's arms were extended in front of him and tightly pressed together. In this position a marked infraclavicular and supraclavicular depression became apparent.

There was a slight depression of the nipple on the affected side. The child was strong and active, and apparently used his arm as if there was no defect.

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FRACTURE OF THE LOWER ARTICULAR SURFACE OF THE TIBIA IN FRACTURE DISLOCATION OF THE ANKLE

BY ANDREW P. MACKINNON, M.D., WINNIPEG, CANADA

INTRODUCTION

The relative position of foot and leg at the time of injury has been much discussed in connection with the mechanism of the different fracture dislocations about the ankle joint.

The rôles of eversion and inversion have been given a great deal of attention ever since the publications of Sir Percival Pott in 1768 and of Dupuytren in 1819. Quite recently Ashhurst[1] has called attention to the importance of forced outward rotation of the foot around the vertical axis of the leg in this connection, and seems to have proved that this is the essential factor in the majority of these injuries. It is the purpose of this paper to discuss two types of fracture which appear to result from forced plantar flexion and forced dorsiflexion respectively. I refer to the cases in which a fragment is broken off either behind or in front, including a part of the lower articular surface of the tibia. Different writers have given different names to these fractures, none of which is completely descriptive, but perhaps the most satisfactory are "posterior and anterior marginal fractures of the tibia". They are mentioned in most of the latest works on fractures, but usually very briefly; and their importance does not appear to be realized by many of those who are called upon to treat this difficult class of cases. We are indebted to Cotton[2] for calling attention to the posterior marginal fracture in 1915, and since that time it has been frequently referred to as the "Cotton fracture", but as pointed out by Ashhurst, it had been described by Astley Cooper in 1822, and subsequently by several writers during the nineteenth century.

INCIDENCE

These fractures are not uncommon. Ashhurst[1] found fifty-eight of the posterior variety in three hundred cases of ankle joint fracture. In two hundred and forty-nine ankle joint injuries with fracture reported by Stevens[3], there were thirty-two of what he calls "impact splits of the tibia".

The accompanying table shows the sites of fracture in one hundred consecutive cases recently radiographed in the Winnipeg General Hospital. There were ten posterior and five anterior marginal fractures, and one case in which the fibula was fractured, and the lower epiphysis of the tibia was separated and carried backward with the foot, a condition which should probably be regarded as the adolescent lesion corresponding to posterior

marginal fracture in adults, as suggested by Turner Thomas[4]. On the other hand, the two cases of both anterior and posterior marginal fracture should probably be placed in a different category, and may very properly be called "impact splits of the tibia". Both these patients fell from a considerable height, one of them a distance of thirty-five feet, alighting on the feet. It seems probable that in these cases the astragalus was driven straight upward against the tibia, splitting and shattering it.

TABLE

SITES OF FRACTURE IN ONE HUNDRED CONSECUTIVE CASES OF FRACTURE ABOUT THE ANKLE, RECENTLY RADIOGRAPHED IN THE WINNIPEG GENERAL HOSPITAL.

1.	Fibula (or lateral malleolus) only			43
2.	Medial malleolus only			7
3.	Fibula and medial malleolus only			28
4.	Fibula and medial malleolus and astragalus			2
5.	Astragalus only			2
6.	Posterior marginal fracture of tibia			
	(a) alone	0		
	(b) with fibula only	3		
	(c) with medial malleolus only	2		
	(d) with fibula and medial malleolus	5	Total	10
7.	Anterior marginal fracture			
	(a) alone	1		
	(b) with fibula only	2		
	(c) with medial malleolus only	0		
	(d) with fibula and medial malleolus	2	Total	5
8.	Fracture of fibula and separation and backward displacement of lower epiphysis of tibia			1
9.	Anterior and posterior marginal fracture with fracture of both malleoli			2
			Total	100

ANATOMICAL CONSIDERATIONS AND MECHANISM

It will be remembered that the lower articular surface of the tibia is concave from before backward. This concavity is quite marked. In a number of specimens recently measured in the anatomical department of The University of Manitoba, its average depth proved to be five millimeters. In the fresh state it would be much deeper, as the anterior and posterior lips of this surface are reenforced by rims of cartilage and ligamentous tissue. This constitutes a real bony block to backward or forward dislocation of the foot. Indeed such dislocation seldom occurs without fracture into this surface.

Figure 1 (a) can be used to illustrate what is apt to happen when force is applied so as to drive the foot backward and upward when it is in plantar flexion. The astragalus will impinge against the posterior part of the lower articular surface of the tibia, and will tend to break off a fragment there, rather than to pass backward into dislocation without fracture. There are other anatomical factors concerned which are not shown in the figure. Not only the mortise formed by the malleoli, but also the superior articular surface of the astragalus, is narrower behind than in front. Posterior dislocation of the foot therefore is impossible until the malleoli are forced apart. In the ordinary eversion or external rotation fracture of severe grade, the inferior tibiofibular interosseous ligament is torn. In the fracture under consideration it seems probable that the pull of this ligament tends to tear out a mass of the tibia to which it is attached. It should be remembered in this connection that that surface of the tibia into which the lateral malleolus fits is concave. Therefore, the dislocating force, driving backward against the lateral malleolus, will tend to break off the posterior lip of this surface, rather than to rupture the tibiofibular ligaments. These combined forces produce the posterior marginal fracture of the tibia, often as a complication of a Pott's fracture. (As the writer knows of no generally accepted nomenclature for the different fracture-dislocations about the ankle, he has used the term "Pott's fracture" to refer to those cases in which there is a fracture of the lower end of the fibula with some outward displacement of the foot.)

It should be further pointed out that the posterior lip of the inferior articular surface of the tibia projects farther downward than the anterior lip, in some cases four or five millimeters farther. This is another provision on the part of nature to prevent posterior dislocation of the foot, which in ordinary activities such as walking, running, and jumping, might often occur if it were not for these safeguards; but it also helps to account for the fact that posterior marginal fracture of the tibia is more common than the anterior variety.

FIG. 1

(a) Illustrates one aspect of the mechanism of production of posterior marginal fracture of the tibia. The fracturing force drives the astragalus backward and upward against the posterior half of the lower articular surface of the tibia.

(b) Illustrates mechanism of anterior marginal fracture of tibia. The fracturing force drives the astragalus forward and upward against the anterior half of the lower articular surface of the tibia.

In the cases studied it was found impossible as a rule to get an exact account of just what position the limb was in at the time of the accident. It was noteworthy that none of the patients had been subjected to great trauma. In fact most of the accidents occurred in the home. The worse cases

FIG. 2

From a drawing by Dr. A. Blondal of Winnipeg. Illustrates one position that may cause posterior marginal fracture of the tibia. The foot is thrust forward and the heel arrested by the block.

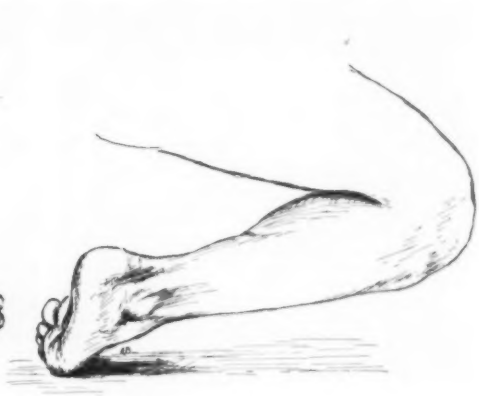

FIG. 3

From a drawing from Dr. A. Blondal of Winnipeg. Shows the position of the foot in Case 13, when the patient sustained a posterior marginal fracture of the tibia.

were in women well on in middle life who were quite stout. One woman (Case 12) stated that she stepped on a loose plank and twisted her foot. Another (Case 6) fell down an embankment. In these two cases it seems probable that the dislocating force would act upon a plantar flexed foot, as in Figure 1 (a) and Figure 2. In this connection Case 13 is of special interest. She slipped on an ice-covered floor, and came down with the "foot doubled under her", so that the dorsum of the foot was in contact with the floor. Here again there would be forced hyper plantar flexion of the foot, as illustrated in Figure 3.

Figure 1 (b) illustrates the mechanism of production of anterior marginal fracture of the lower end of the tibia. When the foot is forced into hyper-dorsiflexion the neck of the astragalus is driven against the downward projecting anterior rim of the inferior articular surface of the tibia. If the tibia gives way under this strain we get an anterior marginal fracture of this bone, perhaps with dislocation forward of the foot. But if the tibia holds, the neck of the astragalus may be broken, as in Figure 4. In this case it would appear that the force continued to act, driving the body of the astragalus backward, dislocating and rotating it.

REVIEW OF CASES

This paper is based upon a study of sixteen cases observed in the Galloway Orthopaedic Clinic during the past four years. All the patients were adults, the oldest being sixty-five. There were five men and eleven women. Thirteen were posterior, and three anterior fractures. Of the thirteen posterior fractures, ten occurred as a complication of Pott's fracture; that is to say the fibula was broken above the ankle joint, the

FIG. 4

Fracture of the neck of the astragalus, produced by the same mechanism as anterior marginal fracture of tibia.

FIG. 5

Case 5. Posterior marginal fracture of tibia with fracture of medial malleolus, and of fibula above the level of the ankle.

medial malleolus was fractured or the deltoid ligament torn and the foot was dislocated backward and outward. In addition a cubical or pyramidal portion of the posterior aspect of the tibia was broken off, and displaced with the lateral malleolus and the foot, backward and outward, and upward about one-half inch. The base of this tibial fragment was formed by the posterior one-half or one-third of the lower articular surface of the tibia. It retained its proper relation to the fibular fragment and to the foot, indicating that the inferior tibiofibular interosseous ligament had not been torn (Fig. 5). In the other three posterior fractures the fibula escaped injury (Fig. 6), but the medial malleolus was broken, and in one of the cases formed a part of the posterior marginal fragment.

Of these thirteen posterior marginal fractures, four were seen within a few days of the accident. None of them presented any special difficulty in treatment. Two had very little displacement, and were simply immobilized in plaster. The other two were typical Pott's fractures, plus

FIG. 6

Case 7. Posterior marginal fracture of tibia, without fracture of the fibula.

FIG. 7

Case 12. Posterior marginal fracture of the tibia with little upward displacement of the fragment.

posterior marginal fracture of the lower end of the tibia. They were treated as detailed below and recovered satisfactorily.

FIG. 8

Case 16. E. J. L. Anterior marginal fracture of tibia only. No dislocation.

The remaining nine patients came for treatment at periods varying from four weeks to seven years after fracture. The usual history was that after the retentive apparatus had been removed, either the doctor or the patient, or both, were dissatisfied with the result, and orthopaedic advice was sought. In all but two of these cases the lesion was as described above, an unreduced Pott's fracture with, in addition, a posterior marginal fracture of the tibia. In the other two cases the fibula had escaped injury, but the medial malleolus was broken, and in one case formed a part of the posterior marginal fracture. These nine cases were treated as follows: In one case (Case 12, Fig. 7), the amount of dislocation was not serious. After a period of physiotherapy, she was fitted with a Whitman plate, and returned to full duty as a hospital nurse four months after her accident. However, the normal concavity of the lower articular surface of the tibia had not been restored, and she has not had a perfect restoration of function. A second patient (Case 11) seen four weeks after her accident, was operated upon. The fracture was reconstituted and reduced. We expect her to do well, but do not know the final result. A third patient (Case 6, Fig. 9), seen nine weeks after her accident, also had her dislocation reduced at open operation, after the tibial fragment had been removed. She has made an excellent recovery, and is now, two years after operation, living a very active life as an organizer for a fraternal society. But in six of the nine cases, restoration of a useful joint appeared hopeless, and an arthrodesis of the ankle was done.

The three cases of anterior marginal fracture may be summarized as follows: One patient (Case 16, Fig. 8) came for treatment the second day following his accident. His only bone injury was to the lower end of the tibia, a column of bone one and one-half inches high including the anterior two-fifths of the inferior articular surface of the tibia had been driven upward and impacted. The foot was not displaced. He was treated conservatively and was back to work as a carpenter in nine weeks; but when last seen, eight months after his accident, he still complained that he could not run with comfort. It is possible that he would have done better if an open operation had been performed, so as to restore the normal concavity of the lower articular surface of this tibia. The other two patients had essentially the same lesion. In each, in addition to the anterior marginal fracture of the tibia, the medial malleolus was broken, the fibula was

fractured above the ankle joint, and the foot was displaced upward and forward. In the case of one of them (Case 14) the fracture was compound. She came under our care several days after her accident with a suppurating wound. Later an attempt to correct the deformity by open operation was only partially successful, and when last seen, fourteen months after her accident, she still walked with a limp, and her disability was estimated at forty per cent. The other patient (Case 15, Fig. 10) was seen after consolidation was complete. In this case we advised and carried out an arthrodesis of the ankle joint.

COMMENT

It will be seen from this review of the above cases that these fractures may, and in fact often do, give rise to serious disability. In our experience they account for a large proportion of the bad results following fracture or dislocation of the ankle. Indeed during the past four years there has come to our notice no case of injury to the ankle requiring radical operation because of bad functional results following conservative treatment elsewhere, except the ten cases in this series, and two cases of fracture of the astragalus.

How are these bad results to be avoided? The answer to this question will of course depend upon the nature of the fracture and dislocation present. In the commonest variety, namely that in which there is a Pott's fracture plus a posterior marginal fracture of the tibia, it would appear that the accepted plan of treatment for Pott's fracture will give a good result, provided that all the details are carefully attended to. The manipulations for the reduction of a Pott's fracture are well known, but they are

FIG. 9

Case 6. (a) Before reduction. (b) Two years after reduction.

FIG. 10

Case 15. Anterior marginal fracture of tibia with forward luxation of the foot. (a) On admission. (b) After arthrodesis.

so important that the writer will take the liberty of reviewing them. With the patient anaesthetized, and the knee held by an assistant in the flexed position, the operator grasps the heel with his right hand, and the lower part of the leg with his left, and makes strong traction upon the foot. This traction is kept up until the foot has been brought forward to correct the backward dislocation, dorsiflexed to a right angle and beyond, and inverted strongly so that the astragalus hugs the medial malleolus. In the ordinary Pott's fracture, when this position has been attained, there is very little tendency for the deformity to recur as long as the foot is kept pressed up into dorsiflexion and in inversion. But in the fracture under consideration, because of the loss of support of the posterior lip of the lower articular surface of the tibia, backward dislocation is sure to recur, unless special pains are taken to prevent it. Many different methods of fixation after reduction have been recommended, all of which *may be* satisfactory, but a well padded plaster-of-Paris dressing *is* satisfactory. The assistant can hold the foot in position while the plaster is being applied, and as the plaster is hardening can maintain the dorsiflexion and inversion, while the operator "rubs in" the plaster behind the well padded heel and in front of the lower end of the tibia, thus insuring against subsequent recurrence of the dislocation. Skiagrams taken through the plaster after it has dried should show the fragments in proper position. If they do not, open reduction with or without internal fixation becomes indicated, because if these fractures are not fully reduced, serious disability is sure to result.

As to after-treatment, the patient will ordinarily be allowed up on crutches during the second week. Gentle passive and active movement should be instituted as soon as one can reasonably assume that the fragments are sufficiently consolidated, probably in four or five weeks. Weight-bearing should not be permitted until much later, because as long as the callus is soft it will yield under strain. Eight to ten weeks is soon enough to allow weight-bearing in the most favorable cases, and better results will be obtained if the foot is protected during the first few months of weight-bearing by a foot plate, or modified boot, or outside iron and T.-strap, or a combination of these.

In the other cases of posterior marginal fracture, in which the fibula has escaped injury, and there is no outward dislocation of the foot, much the same treatment is indicated. Inversion must not be overdone, but it is well to remember that under all circumstances an everted foot is a weak foot, and there is very seldom any trouble in securing sufficient supination of the foot after a period of immobilization, whereas a tendency to pronation is usual after most ankle injuries.

In the treatment of the anterior marginal fractures, the indications are to correct the forward dislocation of the foot, and to restore the integrity of the inferior articular surface of the tibia. If these indications can be met with manipulation followed by retention in plaster, the results will be good. If pictures taken through the plaster after manipulation show incomplete reduction, open reduction becomes indicated.

SUMMARY

1. Posterior and anterior marginal fractures of the tibia occur not infrequently as complications of fracture dislocation about the ankle, and account for many of the bad results in this class of cases.

2. The posterior marginal fracture is most often accompanied by a fracture of the lower end of the fibula and of the medial malleolus, and should be treated in the same way as the ordinary Pott's fracture, special attention being paid to the prevention of recurrence of the backward dislocation of the foot.

3. Anterior marginal fracture may be associated with fracture of both malleoli, and anterior dislocation of the foot.

4. In the treatment of both these fractures complete reduction of the dislocation and restoration of the integrity of the inferior articular surface of the tibia must be obtained, either by manipulation or by open operation.

SUMMARY OF CASES

A. Posterior Marginal Fracture of the Tibia.

Case 1. No. 13662. Mrs. J. T. C., age fifty. Seen five months after having fractured her ankle, as a result of stepping on a piece of coal. A large heavy woman. Walks only with crutches. X-ray shows fracture of medial malleolus and of fibula above the ankle joint, with a pyramidal fragment broken off the posterior aspect of the tibia, the base of the pyramid formed by the posterior two-fifths of the lower articular surface of the tibia. This fragment displaced backward and upward half an inch, permitting posterior dislocation of the foot. The fibular fragment appears to have retained its proper relation to the foot.

Treatment. April 12, 1922. Arthrodesis of ankle.

Case 2. No. 14849. Mrs. St. J., age forty-eight. Seen four months after her accident. Has been treated for a "sprain". A heavy woman. Walks only with crutches. Foot swollen, discolored, displaced backward. X-ray as in Case 1.

Treatment. May 22, 1923. Arthrodesis of ankle.

Case 3. No. 15210. P. J. H. Seen two weeks after accident. While ploughing he caught his foot in a root. A pyramid of bone including a part of the medial malleolus and the posterior two-fifths of the inferior articular surface of the tibia had been broken off and displaced somewhat backward and upward.

Treatment. Oct. 1, 1923. Anaesthetic. Heel drawn forward, and foot forced into dorsiflexion. Plaster. Result satisfactory.

Case 4. No. 15346. L. J., age thirty. Seen one hour after accident at football. X-ray showed fracture of external malleolus about the ankle, and a chip broken off the posterior margin of the articular surface of the tibia. Foot not dislocated.

Treatment. Nov. 10, 1923. Manipulation and plaster. Result perfect.

Case 5. No. 15679. Mrs. A. M. B., age fifty-three. Seen six weeks after her accident. A very heavy woman. Cannot bear any weight on the foot. X-ray as in Case 1.

Treatment. April 16, 1924. Arthrodesis of ankle.

Case 6. No. 15976. Mrs. C. B., age forty-three. Seen nine weeks after having tumbled down an embankment. She now walks mostly with crutches, but can get about with a cane. X-ray as in Case 1, except that the medial malleolus is not fractured.

Treatment. Oct. 4, 1924. Operation. Tibial fragment removed, and foot drawn forward. She wore plaster for two months. Two years after operation she was working hard as an organizer for a fraternal society.

CASE 7. No. 16573. Mrs. S. A., age fifty-one. Seen six months after accident. Had been treated in plaster for the first two months. Now walks only with crutches. X-ray as in Case 1, except that fibula is not involved.

Treatment. Oct. 17, 1925. Arthrodesis of ankle.

CASE 8. No. 16623. G. M., age fifty-six. Seen seven years after accident. For two years he walked on crutches. Very marked deformity. Foot in equinus, displaced backward and outward. Patient walks on his toes. X-ray shows an old united fracture of medial malleolus and of fibula above the ankle, and a posterior marginal fracture of the tibia.

Treatment. Nov. 23, 1925. Arthrodesis of ankle.

CASE 9. No. 16672. Mrs. A. J. K., age twenty-eight. Seen a few hours after having fallen on the hardwood floor. A large heavy woman. Her physician had already applied a splint, and no doubt had improved the position. X-ray showed fibula fractured three and one-half inches above the ankle joint. A cubical fragment broken from lower aspect of tibia, and displaced upward one-eighth of an inch. Foot not dislocated.

Treatment. Dec. 10, 1925. Manipulation and plaster as for Pott's fracture. Painless weight-bearing in two months.

CASE 10. No. 17016. Mrs. F. R. C., age forty-two. Seen eight months after she had fallen and broken her ankle. Weight 250 pounds. Foot swollen. Displaced backward and outward. Walks on crutches only. X-ray as in Case 1.

Treatment. June 4, 1926. Arthrodesis of ankle.

CASE 11. No. 17198. Mrs. E. E. N., age forty-five. Seen one month after accident. Sent in by her physician, wearing plaster. X-ray as in Case 1.

Treatment. Sept. 10, 1926. Open reduction after reconstitution of the fracture and tenotomy of tendo Achillis. Plaster with foot in dorsiflexion and inversion. Final result not known.

CASE 12. No. 17236. Miss B., age fifty. Seen eleven weeks after her accident. Stepped on a loose plank in sidewalk and twisted her foot. Wore plaster for two months, and began to try to bear weight two weeks later. X-ray as in Case 1, except that fragments are in very good position. The normal concavity of the articular surface of the tibia is not present however.

Treatment. Sept. 28, 1926. Baking and massage. Whitman plate. Weight-bearing. Returned to her work as a hospital nurse five weeks later, and has since done full duty.

CASE 13. No. 17342. Miss M. H., age fifty-two. Seen ten days after her accident. Slipped on the icy floor and came down with the foot "doubled under her", so that the dorsal surface of the foot was in contact with the floor. Foot now much swollen. Blebs have formed. It is dislocated backward, and rotated so that the toes point outward. X-ray substantially the same as Case 1.

Treatment. Dec. 3, 1926. Manipulation and plaster with foot in dorsiflexion. Subsequent x-ray shows good position. We expect her to do well.

B. ANTERIOR MARGINAL FRACTURE OF THE TIBIA.

CASE 14. No. 15908. Mrs. L. S., age sixty-five. Seen ten days after accident. Stepped off a street car and caught foot between two drain pipes. Fracture compound. X-ray showed the fibula fracture above the ankle, the internal malleolus broken, and a cube of bone broken off the lower end of the tibia in front. This fragment included the anterior two-fifths of the lower articular surface of the tibia. The foot is displaced forward.

Treatment. Aug. 21, 1924. Open reduction. Plaster. Fourteen months later disability was estimated at forty per cent.

CASE 15. No. 16185. H. A. L., age forty-two. Seen three months after accident. Walking on crutches. Foot displaced forward. X-ray shows oblique fracture of fibula three and one-half inches above the ankle. The fragment included the anterior two-fifths of the articular surface and a part of the internal malleolus, and extended upward

one and one-quarter inches. Its upper end seemed to be impacted. Foot dislocated forward, and displaced upward half an inch.

Treatment. Nov. 12, 1924. Arthrodesis of the ankle.

CASE 16. No. 14711. E. J. L., age twenty-one. Seen two days after accident. Fell twenty-five feet, alighting on a cement floor covered with building material, which may have forced the foot into acute dorsiflexion. X-ray showed only "anterior marginal fracture" of tibia. Fragment cubical in shape, one to one and one-half inches in its various dimensions, and driven upward slightly.

Treatment. April 8, 1923. Fixation in plaster. Was back to work as a carpenter eight weeks later, but at the end of eight months could not run.

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News Notes

The Forty-Second Annual Meeting of The American Orthopaedic Association will be held at the Mayflower Hotel in Washington, D. C., on May 1, 2 and 3, 1928. The preliminary program, as outlined by the Committee, is as follows:

PRELIMINARY PROGRAM

A. First Day: Tuesday, May 1st. 9.30 A.M.

1. Address of the President.
   DR. A. MACKENZIE FORBES OF MONTREAL, CANADA.
2. Why do Some Giant Cell Tumors Recur After Curetting and Why is Ossification Sometimes Incomplete in the Benign Bone Cyst.
   DR. JOSEPH COLT BLOODGOOD OF BALTIMORE, MD. (By invitation.)
3. The Early Diagnosis of Sarcoma of the Long Bones, Based upon the Clinical, Pathological, and X-ray Findings.
   DR. WILLIAM B. COLEY OF NEW YORK CITY. (By invitation.)
4. Ossifying Haematoma.
   DR. SYDNEY M. CONE OF BALTIMORE, MD.
5. Non-union of the Tibia in Children.
   DR. MELVIN S. HENDERSON OF ROCHESTER, MINN.
6. Posterior Capsuloplasty in Certain Flexion Contractures of the Knee.
   DR. PHILIP D. WILSON OF BOSTON, MASS.
7. A Further Report on the Transplantation of the Tensor Fascia Femoris Muscle for the Purpose of Stabilizing the Hip Joint in Infantile Paralysis.
   DR. FRANK D. DICKSON OF KANSAS CITY, MO.

B. First Day: Tuesday, May 1st. 2.00 P.M.

8. Peripheral Nerve Complication of Certain Fractures.

MR. HARRY PLATT, M.S., F.R.C.S., OF MANCHESTER, ENGLAND. (By invitation.)

9. A Demonstration of the Abduction Method and the Reconstruction Operation as Exponents of a Comprehensive and Standardized Treatment of Fracture of the Neck of the Femur.
   DR. ROYAL WHITMAN OF NEW YORK CITY.
10. Further Study of Crush Fractures of the Spine.
    DR. JAMES O. WALLACE OF PITTSBURH, PA.
11. Fractures of Cervical Vertebrae, with and without Spinal Cord Injury.
    DR. ROBERT D. SCHROCK OF OMAHA, NEB.
12. Supracondylar Fractures of the Elbow Joint. Some Problems and Complications.
    DR. CHARLES F. EIKENBARY OF SEATTLE, WASH.
13. End Results of Arthroplasty of the Knee.
    DR. WILLIS C. CAMPBELL OF MEMPHIS, TENN.

Second Day: Wednesday, May 2nd. 9.00 A.M.

14. Congenital Dislocation of the Hip. Report of an Unusual Case.
    DR. JOHN RIDLON OF CHICAGO, ILL.
15. An Operation for the Reduction of Certain Types of Congenital Dislocation of the Hip.
    DR. PAUL P. SWETT OF HARTFORD, CONN.
16. The Developmental Changes in the Hip in Congenital Dislocation—Their Importance in Treatment.
    DR. NATHANIEL ALLISON OF BOSTON, MASS.

17. Reconstruction of the Hip in Irreducible Dislocations, Congenital and Pathological.
Dr. A. Bruce Gill of Philadelphia, Pa.
18. Problems in the Diagnosis and Treatment of Osteo-arthritis of the Hip Joint.
Dr. Elliott G. Brackett of Boston, Mass.
19. Some Orthopaedic Problems of the Lower Jaw.
Dr. Robert Ivy of Philadelphia, Pa. (By invitation.)
20. Diagnosis and Treatment of Acute Arthritis of the Hip.
Dr. Philip W. Nathan of New York City

C. Third Day: Thursday, May 3rd. 9.00 A.M.

21. The Treatment of Wound Infections Especially of Bones and Joints without Sutures, Drainage Tubes, or Antiseptic Dressings. Lantern Slides.
Dr. H. Winnett Orr of Lincoln, Neb.
22. Prognostic Signs in the X-rays of Tuberculous Spines in Children.
Dr. Ralph K. Ghormley of Boston, Mass.
23. Tuberculosis of the Spine. A Report of the End Results in All Cases Treated by Fusion at the New York Orthopaedic Hospital, January 1915 to January 1920.
Dr. Russell A. Hibbs of New York City
24. Results of Spine Fusion for Scoliosis.
Dr. Samuel Kleinberg of New York City
25. Bactericidal Action of Various Metals Upon Certain Organisms in Relation to Metallic Internal Fixation of Tissues.
Dr. J. Torrance Rugh of Philadelphia, Pa.
26. Report of a Case of Sclerosing Osteomyelitis Associated with Trichinosis.
Dr. George E. Bennett of Baltimore, Md.
27. Polyarthritis with Special Reference to Bacteriology.
Dr. Alexander Gibson, Winnipeg, Canada

On April 30, the day preceding the meeting, a Clinical Day, to be held in Washington, is being arranged by Dr. A. R. Shands, of Washington.

Additional information as to the plans for the meeting may be secured from the Secretary of the Association, Dr. DeForest P. Willard, 1729 Spruce St., Philadelphia, Pa.

The *Journal* is very glad to announce the appointment of Dr. Vittorio Putti of Bologna, Italy, to the staff of Foreign Editors. The *Journal* congratulates itself on having such a representative in Italy.

Dr. W. Barnett Owen has moved his office to 822 The Heyburn Building, Louisville, Ky.

Dr. Emil S. Geist and Dr. Myron O. Henry announce their association in partnership at 823 Nicollet Avenue, Minneapolis, Minn.

The surgery of Dr. A. Mackenzie Forbes has been moved to 739 Sherbrooke Street West, Montreal.

Dr. J. W. McCammon has opened an office in the Pearl Market Bank Building, Seventh and Race Streets, Cincinnati, Ohio.

Dr. J. M. King, Jr. has received the appointment of Orthopaedic Surgeon to the Pittsburgh Hospital.

Dr. M. A. Blumer is assisting on the Orthopaedic Service of Dr. David Silver at Allegheny General Hospital, Pittsburgh.

Dr. David Silver has resigned as Medical Director of the Children's Hospital of Pittsburgh, but will continue his staff activities as Director of the Orthopaedic Service.

Dr. Joseph A. Freiberg, who has just returned from his studies in Europe, following two years spent in Boston at the Massachusetts General and Children's Hospitals, is now associated in practice with his father, Dr. Albert H. Freiberg. Their office is at Seventh and Race Streets, Cincinnati, Ohio.

Dr. Carl C. Yount and Dr. George Wright of Pittsburgh talked on the orthopaedic and neurologic phases of anterior poliomyelitis before the **Medical Society of Wheeling,** West Virginia. This meeting was well attended, as keen interest in this disease had been aroused on account of the fact that the community suffered a fair sized epidemic during the fall months. Miss Evans, who was formerly connected with the Watson Home for Crippled Children in Pittsburgh, attended the meeting and talked of her work in the Wheeling epidemic.

At the annual meeting of the **Chicago Orthopaedic Club,** held on February 10, the following officers were elected:

Dr. Philip Lewin—President
Dr. F. C. Test—Vice President
Dr. F. A. Chandler—Secretary and Treasurer

The program included the following:

1. Demonstration of a case of fractured astragalus, by Dr. E. W. Ryerson.
2. Rest in the Treatment of Chronic Joint Disease, by Dr. John Ridlon.
3. Brachial Birth Palsy, by Dr. E. D. Hauser.
4. Demonstration of the arthroscope, by Dr. Philip H. Kreuscher.
5. Metastatic Suppurative Synovitis, by Dr. M. A. Bernstein.

At the meeting of the Chicago Orthopaedic Club held at the Crerar Library on March 9, a paper was presented by Dr. J. Albert Key of St. Louis, Mo., on "Physiology and Reactions of Joints".

At the meeting of the Executive Committee of the **British Orthopaedic Association,** held on February 2, the following were elected Associate Members:

Patrick F. McFarlan, 3 Park Terrace, Stirling.
Henry Osmonde Clarke, Brookeborough, Co. Fermanagh, Ireland.
Miss Margaret Hyde Greg, Biddulph Grange Orthopaedic Hospital, Biddulph, Nr. Stoke-on-Trent, Staffs.

The First International Congress of the **Oto-Rhino-Laryngological Society** will be held in Copenhagen, Denmark, July 29 to August 1. More than seventy-five specialists will represent the United States at the Congress. These doctors will also spend some time visiting in France, England, Germany, Norway and Sweden. Clinical discussions will be held in these countries with European doctors presiding.

Information about the Congress may be obtained from the American Committee of the Society, 25 Broadway, New York.

A clinical tour of Europe has been planned by the **American College of Physical Therapy.** They have arranged for their fellows and interested doctors what may be termed a complete European Review of physical therapy. No less than twenty-one clinics are included in the itinerary, representing England, France, Switzerland, Austria, Germany, and Denmark. The party will sail from New York on May 26. Further information may be obtained from the headquarters at Suite 656, 25 Broadway, New York City.

A Conference on Rheumatic Diseases is to be held at Bath, England, on Thursday and Friday, May 10 and 11, 1928. Sir George Newman, Chief Medical Officer of the British Ministry of Health, has kindly consented to act as President of the Conference. There will be three sessions: (1) Social Aspects, presided over by Lord Dawson of Penn, Physician to H.M. King George, (2) Causation, presided over by Sir Humphry Rolleston, Regius Professor of Physic, University of Cambridge, and (3) Treatment, presided over by Sir E. Farquhar Buzzard, Regius Professor of Medicine, University of Oxford. The local Hon. Medical Secretary is Dr. Vincent Coates, 10, Circus, Bath, England.

State recognition of the high rank of **St. Luke's International Hospital School for Nurses,** Tsukiji, Tokyo, was officially confirmed by the Imperial Japanese Department of Education by the publication, under date of November 24, 1927, of an official decree conferring college (*semmon gakko*) rank on the institution. The course of study is for three years, and one year extra for those taking special higher training.

The School is the first institution for nurses in Japan to be thus recognized, no girls being admitted without a diploma from a girls' high school. St. Luke's International Hospital is under the management of the American Episcopal Mission, and in charge of Dr. R. B. Teusler, Surgeon to the American Embassy.

The **United States Civil Service Commission** announces the following open competitive examinations:

Occupational Therapy Aide (Arts and Crafts)
Occupational Therapy Aide (Trades and Industries)
Occupational Therapy Aide (Poultry Raising)
Occupational Therapy Aide (Gardening)
Social Worker (Psychiatric)
Junior Social Worker
Junior Medical Officer (Intern)
Assistant Medical Officer
Associate Medical Officer
Medical Officer
Senior Medical Officer

Applications will be rated as received by the United States Civil Service Commission at Washington until June 30. Full information may be obtained from the United States Civil Service Commission at Washington, D. C., or the secretary of the United States civil service board of examiners at the post office or customhouse in any city.

The thirteenth Annual Convention of the **Catholic Hospital Association** of the United States and Canada and the Second Annual Hospital Clinical Congress of North America will be held in the Cincinnati Music Hall, Cincinnati, Ohio, June 18 to 22, 1928.

This Convention and Congress will comprise general scientific meetings, special clinics or demonstrations of hospital departments, and three hundred special commercial and educational exhibits. Outstanding authorities in medicine, surgery, pathology, nursing, dietetics and hospital administration, architecture and engineering will lecture and demonstrate in specially planned clinics representing the various departments of the modern hospital. A program of the highest interest and value is now being formulated, and all persons interested in medical and hospital service are cordially invited to attend. Further information may be obtained from John R. Hughes, M.D., Dean of the College of Hospital Administration, Marquette University, Milwaukee, Wisconsin, who is General Chairman of the Convention and Congress.

The Annual Meeting of the **Seattle Orthopaedic Society** was held in Seattle on February 24 and 25. The guest of honor and lecturer was Dr. H. Winnett Orr, of Lincoln, Nebraska, who has done constructive work in osteomyelitis.

Friday morning a dry clinic was presented, which included osteomyelitis cases, chiefly. Saturday morning an operative clinic was held at the Virginia Mason Hospital, with operations on four varied types of osteomyelitis cases. On Saturday afternoon a dry clinic was held, composed chiefly of orthopaedic and post-traumatic cases.

The annual banquet was held Saturday night at the Olympic Hotel, at which Dr. Orr gave a very interesting lecture on the development of the treatment of osteomyelitis and of skeletal fixation of fractures. The lecture was illustrated with lantern slides.

The meeting as a whole was very successful and was attended by a large number of visitors from various parts of the Pacific Northwest.

The meeting of the **Clinical Orthopaedic Society** was held in Memphis, Tenn., on January 9 and 10. On the first morning, Dr. J. S. Speed held a very instructive fracture demonstration at the Willis Campbell Clinic. The outstanding features were his interesting results with massive osteoperiosteal onlay grafts in ununited fractures, held in place with autogenous bone nails, and a very simple but effective splint for fractures of the shaft of the humerus treated by traction.

Dr. Campbell demonstrated a large group of cases of arthroplasty, with motion picture cartoons of the operations. He brought out many points of interest, as the result of his wide experience along this line. He also demonstrated cases of osteitis fibrosa cystica, infectious arthritis, and multiple epiphysitis.

Dr. C. R. Roundtree demonstrated an interesting case of bone tumor, following the removal of an osteochondroma; and a case of non-suppurating osteomyelitis, which was relieved six months after operation.

The afternoon session was held at the St. Joseph Hospital. Dr. Alphonse Meyer and Dr. Edwin J. Lipscomb demonstrated cases of fracture, semilunar cartilage, fracture-dislocation of the spine, rupture of the quadriceps tendon, and rupture of the prepatellar tissues allowing enucleation of the patella.

The following were presented to the meeting: cases showing the result of the drop-foot operation by Dr. Campbell, his series including over two hundred cases; spastic cases by Dr. Mitchell, showing the excellent results following the Stöffel operation; also three cases of spinal fusion with autogenous bone onlays by Dr. Mitchell.

The Society then visited the Hospital for Crippled Adults.

On Tuesday morning an operative clinic was held in the amphitheater of the Memphis General Hospital, where the following operations were performed: an arthroplasty of the elbow, by Dr. Campbell, using his well known technique; transference of the crest of the ilium for correction of flexion deformity in the hip, by Dr. Speed; operation for drop-foot, by Dr. Campbell.

In the afternoon the Society met in the Baptist Memorial Hospital, where Dr. R. E. Semmes showed interesting cases of spinal cord tumor and demonstrated the Quickenstat test. An unusual case of bone sarcoma following the course of an infection, with rapid death, was described by Dr. J. A. McIntosh. Interesting cases of plastic surgery were demonstrated by Dr. J. E. Johnson, who has made frequent use of the caterpillar method. Dr. Campbell demonstrated his operation for extra-articular fusion of the sacro-iliac joint with postoperative results.

Dr. Speed and Dr. Campbell then demonstrated about thirty cases of various types with operative results, including tubercular joints, epiphyseal slipping, dislocations, post-diptheritic paralysis and sacro-iliac disease.

A regular meeting of the **Boston Orthopaedic Club** was held in the Sprague Hall of the Boston Medical Library on Monday evening, December 12.

The first paper was by Dr. Philip D. Wilson on "Posterior Capsuloplasty in Certain Flexion Contractures of the Knee". He described the operation which he has devised for its relief. This consists in freeing all the tissues including the capsule of the knee joint done through two lateral incisions, one on either side, retracting the tissues forward so as to get good exposure of the posterior compartments of the knee. Following this,

the knee is put up in extension and subsequent attention depends on the case, usually requiring some exercises, etc. In his experience practically all of his cases had improved in function of the joint. The joints could be fully extended and the subluxation had been reduced. Three patients were shown on whom the operation had been done, all with very satisfactory results. The paper was discussed by Dr. Painter, Dr. Osgood, and Dr. Ober.

The second paper was by Dr. Robert B. Osgood and Dr. Charles C. Lund on "Fractures of the Odontoid Process". Dr. Osgood reviewed the literature on the subject and the cases that have been previously reported, the anatomy, pathology, and treatment. He advocated extension and fixation and no manipulation. The type of leather head support used was shown and the postoperative treatment outlined. The paper was discussed by Dr. Jepson, Dr. Wilson, and Dr. Ober.

After the meeting, the exhibit of art by medical men was inspected.

A meeting of the Boston Orthopaedic Club was held on Monday, January 23, 1928, in the Boston Medical Library.

The report of the committee appointed to effect a reorganization of the Club was heard, this reorganization consisting of a new set of by-laws and constitution, the name to remain the same.

The nominating committee reported for President, Dr. James W. Sever; for Secretary, Dr. R. K. Ghormley; for member of the Executive Committee for three years, Dr. A. L. Brett; for two years, Dr. Murray Danforth; for one year, Dr. John W. O'Meara. The nominations were closed and the secretary was instructed to cast a unanimous ballot.

The papers of the evening were then read. The first was by Dr. Scudder, who reported on Delbet's treatment of fifteen cases of fractured neck of the femur treated by fibula graft, with good results in thirteen of the cases. Dr. Scudder's point was to bring out this type of treatment, and the discussion which followed favored the bony operations rather than fixation by foreign material.

Dr. Jepson's paper was then read, in which he treated the question of non-union and discussed the causes and the various types of treatment. He favored the inlay graft in the tibia, and elsewhere the massive graft. He favored the use of beef bone screws. The paper was discussed by Dr. Cotton, Dr. Scudder, Dr. Wilson, Dr. Betts, a visiting surgeon from Australia, and Dr. Sever.

A meeting of the Boston Orthopaedic Club was held in the Sprague Hall of the Boston Medical Library on February 13, 1928. There were about sixty members and guests present.

The first paper of the evening was by Dr. Sever on "Fractures of the Pelvis". He reported fifty-one cases, divided: twelve of the ilium, twenty-five of the pubic arch, and fourteen of the acetabulum. His impression was that the results in general were better than indicated in the literature, which showed a very high mortality, whereas of his cases only one died. He said this discrepancy might be due to the type of injury received, the more severe types being found in mining areas. For treatment he advocated principally rest in bed, tight swathe, occasionally traction for fracture of the acetabulum. The paper was discussed by Dr. Stone, Dr. Osgood, Dr. Ober, and Dr. Wilson.

The second paper of the evening was by Dr. Allison on "The Adaptive Changes in the Hip in Congenital Dislocation". He showed a series of lantern slides from the foetus on up through adult life, and the point he brought out was that there are adaptive changes in the head of the femur which exist both before and after reduction and persist throughout life. This paper was discussed by Dr. Osgood, Dr. Morrison, and Dr. Wilson.

The third paper was by Dr. Cotton on "Ruptured Biceps". He stated that the long head is always the one ruptured, and it ruptures practically always at the joint, probably due to some previous weakening of the tendon at that point. His procedure is to take the tendon, pass it through the deltoid attachment and back over the muscle, and reef it there with sutures. His results have been very satisfactory, and he felt that the operation, being so simple, was worth reporting.

At the meeting of the Boston Orthopaedic Club, held in Sprague Hall of the Boston Medical Library on Monday, March 12, Dr. Sever, the president, presided.

The first paper of the evening was by Dr. Merrill K. Lindsay, of New Haven, on "Relaxed Motion in the Treatment of Fractures of the Upper Extremities". Dr. Lindsay described his method of treatment of elbow and shoulder fractures, this consisting in reduction of the elbow under a flouroscope, after a period of massage had decreased the swelling. He emphasized that this massage must be gentle. After a half hour the swelling is reduced so that acute flexion can be brought about, and the arm is put up in acute flexion. On the first day after reduction, gentle massage is given and the arm allowed to extend after relaxation of the muscles. This is kept up daily, and at the end of his treatment, in practically every case, perfect motion was obtained. In the case of shoulders he puts them on a Jones' humerus traction splint with modified attachment, and this is removed each day and the shoulder allowed to circumduct. With the patient leaning forward against a table, by flexing the knee on the side of the fracture, rotary motion can be obtained without exertion. The results in shoulder fractures were equally good. The paper was discussed by Dr. Osgood, Dr. Wilson, Dr. Ober, Dr. Painter, Dr. Colquehouns, Dr. Allen, Dr. Fitzsimmons.

The second paper of the evening was by Dr. E. A. Codman on "Diagnosis of Conditions about the Shoulder Joint". His paper represented a study of 349 cases of painful shoulders. Of these he operated on 140 cases. He divides the clinical conditions into twelve different types. Among these are mild and acute subacromial bursitis, ruptured supraspinatus tendon, calcareous bursae, precalcareous deposits, chronic adherent types of bursitis, chronic non-adherent types of bursitis, displaced tuberosity, brachial plexus injuries, etc. He described accurately the signs and symptoms in each of these conditions, particularly in bursitis and ruptured supraspinatus. He advocated operative rather than non-operative treatment in both of these conditions, and felt that the end results after operation were much better than those obtained without operation. This paper was discussed by Dr. Osgood.

The third paper of the evening was by Dr. Painter on "Thrombo-angiitis Obliterans". On account of the lateness of the hour Dr. Painter only summarized the contents of his paper, pointing out that many cases of thrombo-angiitis obliterans, in which an amputation had been performed, later had to have the other foot amputated; so that the results were not satisfactory. He said that the collateral circulation established often took care of the extremity so that gangrene was avoided. He advocated holding over against operation. The paper was discussed by Dr. Allen, who told of the work at the Massachusetts General Hospital in the use of typhoid vaccine as a protein shock. This produces practically the same condition as is obtained with perivascular sympathectomy. The results obtained are very striking, in some cases almost complete recovery being obtained. In others considerable improvement was shown, so that in general the results to date were very satisfactory. He pointed out that this work has not yet been published, but is going to be reported at the coming meeting of the American Medical Association.

The following papers on orthopaedic subjects have been read recently before different meetings in Pittsburgh:

(1) "Osteosarcoma of the Os Calcis." By Eben W. Fisk, M.D.

(Read before the **Allegheny County Medical Society.**)

Case Report: Italian, eighteen years of age, complaining of swelling and tenderness on the plantar surface of the right heel. The x-ray showed hazy periosteal proliferation on the inferior surface of the os calcis. He was first seen on September 19, 1921, and later in November, 1921. In November the x-ray showed marked increase in the proliferation. Biopsy was done on November 21, and the pathological diagnosis was osteochondroma. Patient refused treatment and left the hospital, but returned in January, 1922, seven weeks after the biopsy, with the foot enormously swollen. Amputation in the middle of the leg was done on January 14,

1922, and the pathological report at that time was osteochondromyxosarcoma. This diagnosis was confirmed by Dr. Bloodgood of Baltimore. The point of special interest in this case is that the patient was alive and in good health and with no recurrence in the extremity in January 1926, five years after amputation.

(2) "Differential Diagnosis of Bone Diseases, Bone Tumors, and Bone Cysts." By Paul B. Steele, M.D.

(Read before the **Allegheny County Medical Society.**)

A large number of x-rays of various bone and joint conditions gathered in the clinic of Dr. Silver and in the practice of Dr. Steele were shown and a complete discussion of differential diagnosis given. This paper was rich and valuable in the clinical material.

(3) "Fundamentals in the Treatment of Joint Affections". By David Silver, M.D.

(Read before the **Allegheny County Medical Society.**)

In this paper Dr. Silver very ably and appropriately presented the fundamental principles of treatment in all joint affections. The material was presented in such a way that it was both instructive and interesting to the average general practitioner. While no new features were presented, it is thought that orthopaedic surgeons who are engaged in teaching will find many valuable suggestions in it.

(4) "Diagnosis of Tuberculous Arthritis with Special Reference to the Tuberculin Test." By John A. Heberling, M.D.

(Read before the **Allegheny County Medical Society.**)

In this paper Dr. Heberling attempted to evaluate the diagnostic value of the tuberculin test in 250 cases treated in the orthopaedic wards of the Allegheny General Hospital in Pittsburgh. His conclusions were:

1. The tuberculin test is of value as a diagnostic aid in joint disease.
2. Its value decreases with the age of the patient.
3. Negative reactions are more valuable than positive ones.
4. The degree of reaction does not correspond to the severity or extent of the joint lesion.
5. Intracutaneous injection of a measured amount of solution is a better method than Von Pirquet test.
6. Systemic reaction should be observed as well as local.
7. The element of danger in its use is negligible.

(5) "Internal Derangement of the Knee Joint." By J. O. Wallace, M.D.

(Read before the **Pittsburgh Academy of Medicine.**)

This paper is a study of seventy cases in which arthrotomy was done for internal derangement of the knee joint. The object was to present the latest knowledge of the anatomy and physiology of the joint and the actual pathology as seen and obtained at operation. An attempt was made to correlate and explain clinical symptoms and findings with pathologic anatomy and physiology and to develop a better understanding of the treatment of these cases.

Dr. J. G. Wishner, Adjunct Orthopaedic Surgeon of the Hospital for Joint Diseases, New York City, was granted the **Henry W. Frauenthal Scholarship** by that Hospital and has undertaken his first year's study of Orthopaedics in Europe. Dr. Wishner left on January 10, and his reports are looked for with great interest as he is the first recipient of the Frauenthal Scholarship.

Gibney Memorial Fellowship Fund

At the last meeting of the Alumni Association of the Hospital for Ruptured and Crippled, New York City, it was voted to establish a fellowship at the Hospital to be known as the Virgil Pendleton Gibney Fellowship, to commemorate the long period—covering more than a half century—of invaluable service which Dr. Gibney rendered to the Hospital. Although the matter thus far has been brought to the attention of only

the Alumni and a few of Dr. Gibney's personal friends, the major portion of the amount desired ($30,000) has already been raised. The committee in charge feels quite certain that there are many other friends and admirers of Dr. Gibney who would welcome an opportunity to contribute to this fund.

The idea of the proposed fellowship is to afford an opportunity to a man who is well grounded in general surgery and who has had a certain amount of experience in orthopaedic surgery, to pursue further study in the latter field. The incumbent of this fellowship will have every opportunity for clinical studies in both the Indoor and Outdoor Departments of the Hospital for Ruptured and Crippled, under the immediate supervision of the heads of the departments. He will have the privilege of studying the pathology of bone tumors at the Memorial Hospital laboratory under Dr. James Ewing; and he will also have the use of the Cornell University Medical College laboratories for research work, and be permitted to pursue research studies in any one of the laboratories of the Cornell University Medical College subject to the approval of the head of the department.

Anyone wishing to contribute to this fund is requested to send his check to Mr. J. D. Flick, Superintendent, 321 E. 42nd St., New York, N. Y.

The Kane Fund

Mr. Robert S. Brewster, President of the New York Orthopaedic Dispensary and Hospital, 420 East 59th Street, has made the following announcement:

"Through the generosity of the late Mrs. John Innes Kane, of 1 West 49th Street, New York, the New York Orthopaedic Dispensary and Hospital is able to announce the founding of the 'Annie C. Kane Fellowships'. These fellowships mark a new departure, which it is confidently hoped will have a far-reaching and beneficial effect not only on the work of the Orthopaedic Hospital but on hospital administration and medical education in general.

"Acting under the authority given them by her will, Mrs. Kane's trustees recently allotted to the Orthopaedic Hospital a fund of over $1,000,000 to make it possible for the hospital to put into effect a plan conceived by the Surgeon-in-chief, Dr. Russell A. Hibbs, for the betterment of medical education. This gift was made by Mrs. Kane's trustees on the understanding that the income be used solely to pay adequate salaries to certain selected young surgeons who, having finished their internship, and showing promise of further development may continue their training in the hospital undisturbed by any considerations other than those pertaining directly to the care of the sick.

"To carry out the purposes of this splendid gift, the hospital authorities have adopted the following plan: Eight fellowships, to be known as 'The Annie C. Kane Fellowships' have been created, carrying annual stipends varying from $9,000 to $4,000. These fellowships will be open to young surgeons of special ability who desire to make their careers in orthopaedic surgery. The appointments will be for three years or, in exceptional cases, for five years, on the understanding that the holders of the fellowships will devote their entire time to the work of the Orthopaedic Hospital or in research or experimental work. The intention is to select for these appointments young doctors who, in addition to completing a full medical course, have had an internship in a good hospital for at least two years. The appointments will be made on the basis of demonstrated worth and are expected to attract men of high technical ability and character. While the majority of the fellowships will doubtless be filled by specially qualified surgeons who have graduated from their internships at the Orthopaedic Hospital itself, some of the appointments will be allotted to men of exceptional ability who have had their training in other hospitals.

"It is believed that these fellowships will not only greatly increase the value of the Orthopaedic Hospital's service to the public but will establish a precedent for the application of similar plans in other great hospitals."

Explaining further the value of Mrs. Kane's gift, Dr. Russell A. Hibbs, Surgeon-in-chief of the Orthopaedic Hospital, made the following statement:

> "In addition to caring for the sick, it is the responsibility of the hospital to train surgeons. This function of the hospital is not only of vital importance in the development of its own staff, but in preparing surgeons for similar responsibilities in other communities. It is now only partially done by internships which necessarily afford only elementary training. By the time the young surgeon reaches this period he will have arrived at the age of twenty-eight or thirty, and in many instances assumed responsibilities such as marriage, et cetera, which force him to devote his time to work that would furnish him immediate financial returns, this work being in large measure valueless in contributing toward his surgical growth. If the interest and the devotion of such men can be held by relieving them of economic pressure for from three to five years at this, the best period of their growing lives, under proper leadership, it should be possible not only to enhance enormously the strength of the staff of this hospital, but to make it possible to send out well trained men to other communities and indeed to meet the primary need in the cure of the sick—surgeons trained and experienced, with a single-minded devotion to their particular branch of surgery."

Industrial Medicine and Rehabilitation in China

The development of preventive industrial medicine and surgery in the Orient should create a large degree of interest throughout the world, particularly in those countries in which so much attention is already paid to the condition of the workmen, both in the prevention of disease and of accidents, and in the care of those injured in industry. Within the last few years one of the large industries in Shanghai, China, appointed Dr. W. S. New, a Harvard and Massachusetts General Hospital graduate, Medical Director of their company, with the object of establishing hygienic and sanitary measures in their factories, and of developing a system which would provide for those who became sick, or who were injured in the course of their work. His recommendations, which were rather revolutionary, were adopted and put into operation. They comprised,—the physical examination of all applicants before their employment; the physical examination of each employee once a year; the opportunity to consult the Director, or his assistants, in matters of health or accident, without loss of pay; the privilege of vaccination in case of epidemics, or of any contagious disease, without expense to the employee (this was not obligatory, but the privilege was practically universally accepted); and the provision to send those becoming sick or injured during the time of their employment to the hospital, at the expense of the company, the employee to receive full pay during the period of his illness. In addition, the suggestions in regard to the establishment of sanitary conditions in the factories were followed. The success of this new movement was so evident, that he was soon asked by several other companies to establish similar methods in their factories, until now about 30,000 workmen in that city are working under these privileges. In addition to the first series of precautionary and preventive methods, some of the factories have now established the custom of allowing to all pregnant women one month's vacation, at the time of delivery, with full pay, and the opportunity after returning to work, to bring their babies with them, with certain periods allowed during the day for their feeding. The minor accidents are reported immediately to the Director or his assistants or nurses, and the major accidents to the Director; and he then investigates the cause which led to it and reports to the company in regard to improvement of technique or equipment, in order to avoid repetition of the same type of casualty if possible.

It is interesting to note that these employers who followed so completely the directions made by Dr. New and his committee, spending large sums of money to provide opportunities for their employees, who had never had consideration before, have evidently made a quick and far leap into this protective system by the imitative methods in which the Oriental is so adaptable, and again they have shown their skill to pick out the essentials of a system and to apply them in an efficient manner. They are evidently

able to grasp essentials of these larger movements, to eliminate the unimportant details which tradition in some countries has proved a hampering obstacle, and these men in the Far East are apparently making an earnest attempt to profit by the experience of industry in other countries and to improve the working conditions of their employees.

Quite recently there has been another step in this movement of recognizing responsibilities toward the individual: an attempt to save human wreckage, made by the Chief of the Army, who has become interested in the reconstruction of men wounded in service. He has conferred on Dr. New the task of providing a plan for the surgical and for the rehabilitative care of the wounded soldiers in his army. They recognize that after the battles there are a number who are rendered unfit for further military service, and unless some provision is made are also unfit for civil service, and that these men, left alone, become beggars or parasites of some form in the community. The plan has been accepted and a Bureau for the care of disabled men has been established and is being put into operation. This Bureau is to organize and maintain three departments;—(1) a hospital department, in which disabled men receive operative and surgical care, and surgical reconstruction; these patients are then discharged from this department and transferred to the department of employment; (2) this employment department has for its duties, to locate these disabled men in existing factories, and to get for them employment. They recognize the disinclination of industrials to employ the handicapped, and it is the duty of this committee to aid the men and the employers in finding some work in which their handicap would not be a detriment in the industry. Those who cannot be so employed are referred to the (3) industrial training school department. In this department, men with particular handicaps are taught trades adaptable to their disabilities. Already the reconstruction hospital is under way, and the plan promises success.

This is in no way different from efforts made by so many countries during the late war, but the Chinese will now have the benefit of the mistakes and failures which have already been made. It will be interesting to see to what extent they are able to adapt these principles to their present conditions, and to benefit by the experience of other countries. Judging from the success in the past, one should look forward with interest and with a good deal of confidence to the success of their efforts in this direction.

Annual Meeting of the Société d'Orthopédie Francaise, October, 1927

SURGICAL TREATMENT OF TUBERCULOSIS OF THE TIBIOTARSAL JOINT

Presented by Dr. A. Delahaye, Berck-Plage, France

Bonnet, in 1840, established the rule of orthopaedic treatment of osteo-articular tuberculosis, but Ollier instituted the surgical treatment of tibiotarsal tuberculosis.

Arrested during the years by the tradition in reference to the development of general tuberculosis, following operations on bone tuberculosis, the surgery of osseous tuberculosis has taken up its rôle since 1890. Victor Ménard, of Berck, advocated astragalectomy with drainage in all cases of extensive tibiotarsal tuberculosis in children. He determined the technique for this, and showed the excellent orthopaedic results which it produced.

The documentary thesis of Andrieu in 1905 presented the opinion of the surgeons at that time. Since then the most complete work is the thesis of Pouzet of Lyon in 1926, which presented the ideas and the results of Nové-Josserand.

The report of Delahaye has a strong plea in favor of astragalectomy in the treatment of tibiotarsal tuberculosis in children. He established, first, that the diagnosis of white swelling of the tarsus is sometimes much more difficult to make with children. It is necessary to distinguish with this the articular reactions which are due to tubercular lesions in the neighborhood (osteites), which figure wrongly in some statistics as arthritis, and heal naturally, with a preservation of the integrity of the function of the articulation. These juxta-articular osteites, which can secondarily invade the tibiotarsal, are suitable for the bloody preventive treatment.

He distinguished in children the following forms:

1. The synovial form without osseous lesions, suitable for immobilization and general treatment.
2. The form, sudden in the beginning, which yields in general to conservative treatment.
3. A serious form, bacillic, with contraindication for any interference.
4. The association with other serious bacterial localizations, which demand the same avoidance of interference.
5. It is in ordinary severe arthritis that there develops a problem of astragalectomy as a therapeutic measure of choice, and this not only at the beginning when the clinical and radiological signs are often doubtful, but after six or eight months of development, when the diagnosis is sure and when it is in the stage of fungosity.

Under these conditions, should one continue the conservative treatment and wait for the appearance of the abscess in the sinuses to perform the astragalectomy with the drainage of Ménard? Is it necessary, on the other hand, with Sorrell and Delahaye, to follow the astragalectomy of choice?

Delahaye says:

"In the presence of the evident tibiotarsal, white swelling with fungosity, originating in the astragalus (the usual place of origin in children), developing during a year, when the lesion appears both clinically and radiographically limited to the tibiotarsal area and when there is no general contraindication, there is no advantage in waiting, but the interest demands an astragalectomy under two conditions; namely, that the white swelling is the only important localization of tuberculosis, and that the patient should be under the best possible hygienic conditions to be operated upon, as for instance, the 'Climatotherapy at the sea'."

The prolonged immobilization entails certain inconveniences (the length of treatment, the considerable trophic disturbances, the frequence of ankylosis—often vicious—the relapses, the possibilities of a final aggravation of the disease); the early astragalectomy should give a cure, quick, complete, with a mobile nearthrosis. Then the author explained the technique of the operation, the needs of postoperative care and, finally, the results (tables, photographs, and radiographs).

In twenty-two cases of astragalectomy in these conditions, two died of tuberculosis (one early and the other late), twenty cures. The operation without drainage was done ten times; with a small drain, twelve times. All healed by primary intention in a time varying from two to five months. There were no secondary abscesses. The time of operative treatment up to the time when the use of foot was resumed again, varies from eighteen to twenty-nine months.

The late results in thirteen children from two to eight years have been excellent; the mobility of the nearthrosis and absence of pain in movements, the foot in scarcely any deformity, and an excellent plantar support, the absence of trophic disturbances; in seven older children (from ten to fourteen years) the results are excellent in three cases, less good in four. All of these being suitable for the immobilization, the astragalectomy gives them far less good results than with very young children.

In conclusion, "The advocates of the astragalectomy of choice think that outside general contraindications, this interference does not present any special danger with children. It allows one to obtain a strong nearthrosis, mobile, painless, and with the foot in scarcely any deformity. The cure as a general thing is obtained relatively quickly, more rapidly than by immobilization under the same circumstances. The bone atrophy of the foot and the muscles of the leg is less marked. The new articulation does not appear any more predisposed to relapse. The results obtained appear, moreover, better when the operation is delayed, within the limits indicated, in order to have a space in the astragalus with relatively healthy walls." The author shows that in reality this opinion is not far removed from the classic opinion, such as was advocated

in the thesis of Pouzet, provided one is willing to agree as to the degree of the severity of the disease of the tibiotarsal articulation and on the meaning of the term "astragalectomy of choice".

SURGICAL TREATMENT OF THE SEVERE WHITE SWELLING IN CHILDREN

In this subject everyone is in accord, as to the astragalectomy of necessity with drainage, of which the indications, the technique and results have been described by Ménard who advocated this procedure.

It is performed in general in the very grave cases where the late operative treatment by extensive astragalectomy (evident in the neighboring bones), and even in certain cases of the posterior tarsectomy. This can be done in two sittings; treatment, by example, of osteitis of the os calcis or of the tibia, then, secondarily, astragalectomy. Most writers and the author are of the opinion that this procedure is the method of choice.

The posterior tarsectomy at one time, of which Nové-Josserand has elaborated the indications, is described afterwards. It gives the functional results as very unequal and always inferior to the typical astragalectomy. It must be reserved for those extremely grave cases, and to attempt to escape the ultimate recourse of amputation. This, in children, should be employed only when one has exhausted all the resources of conservative treatment. This is necessary for the extensive local lesions, the alteration of the bone condition, or the presence of other severe foci.

SURGICAL TREATMENT OF TIBIOTARSAL TUBERCULOSIS IN THE ADOLESCENT AND THE ADULT

Synovial Form: The simple orthopaedic treatment can sometimes result in a cure. Whenever there is no clear clinical or radiographical evidence in favor of the bone involvement, the conservative treatment is the rule.

Fungous Form: From fifteen years it resists immobilization as a rule. The astragalectomy is the treatment of choice, but the functional results are less and less good with the increase of age, and from forty years, amputation is to be preferred.

The posterior tarsectomy is only exceptionally indicated. When the local or general condition demands a severe operation, amputation should be performed and the Syme's operation is the operation of choice, because of the excellent orthopaedic results, but the operation should not be too long delayed, for the extension of the lesion may render operation impracticable. - *Jacques Calvé, M.D., Berck-Plage*

Annual Meeting of the Société d'Orthopédie Francaise, October, 1927

TREATMENT OF CONGENITAL PSEUDARTHROSIS

Presented by Dr. Dujarier, Paris.

The pseudarthroses of the bones of the leg, the most frequent, form the only subject of this work.

The author shows that all the pseudarthroses are not congenital. Along with these there are those which are developed in the congenital curves of the bones of the leg, either by fracture when there is traumatism, or by an osteotomy. In these cases the bones are, because of their congenital defects, particularly disposed to non-union as well as to congenital curves, the congenital pseudarthroses form two degrees of the same malformation of which the ultimate degree is the congenital absence of the bones of the leg.

For the pseudarthrosis itself, Dujarier insists particularly on the fact that of this there exist two types of a different prognosis. The first type, fortunately the most frequent, consists of a curve of the bone of the leg, with, moreover, at the summit of the curve, a break in the continuity of the line; it is a very firm pseudarthrosis; walking is possible with an apparatus. In the second type, the foot is completely flail. The tibia and the fibula are lacking throughout much of their extent. The patient cannot walk, even with apparatus.

In the firm pseudarthroses, the radiograph shows the opacity of the bone more pronounced near the curve and sometimes a disappearance at this point of the medullary cavity, and there is found sometimes between the two bones a fibrous band with a peripheral fibrous union and again a true nearthrosis. The fibula in this form is usually intact. In the loose forms of pseudarthrosis, the fibula and the tibia are interesting. They present a large loss of substance. The fragments are pointed at their end, and at this level the bone is soft and friable.

The future of these congenital pseudarthroses is, according to most surgeons, discouraging. For one thing, the atrophy of the limb is incurable; on the other hand, the consolidation of the pseudarthrosis is most difficult to obtain. The simple freshening, with an oblique osteotomy, following the freshening and the suture, are recognized as habitual failures. The osseous graft constitutes the only procedure which may give a frequent success.

It is necessary to distinguish of these three kinds.

1. The Osteoperiostal-Cutaneous Graft of Reichel.

The graft is taken from the tibia of the opposite side, preserving a pedicle of the skin in order to increase the vitality of the graft. The two limbs are then held together in plaster. The cutaneous bridge is cut on the twentieth day. Reichel in 1903 obtained also a success in a case which had already lapsed twice. Codinlla and Nové-Josserand have had success. The latter, in five cases, obtained two immediate, and one late failure, and two cures dating from five to eighteen years. The author, observing all the success obtained, finds the process rather complicated and does not favorably consider the nutrition of the graft by a bridge of skin which is only slightly vascular.

2. The Large Osseous Graft.

Sometimes, one takes the graft from the fibula of the affected side, using either the free graft or the graft with a pedicle. Failure has been the rule, for the bones on the affected side are atrophied. More often, one takes the graft from the tibia on the opposite side. Leclerc, of Dijon, has had one failure. Albee had a success, after seven years.

3. The Osteoperiostal Graft of Delagénière.

Codinlla, in 1910, employed this the first time in a pseudarthrosis and obtained in three cases, two successes. Brade and Ranenbusch have reported also two cures. Froelich, in 1910, reported four cases; two cures, two failures. Nové-Josserand, Mauclaire, Moutier, of Nantes, each have reported a success. Also the author himself gives the detailed description of five cases which resulted in four successes and one failure.

In the technique of the osteoperiostal grafts applied in different kinds of pseudarthroses there is nothing of interest to report; plaster-of-Paris during two months, then the ambulatory apparatus of Delbet during six months to a year. The postoperative care is most important.

It is necessary to follow these cases during many years, and to watch the development of the callus with the successive x-rays to determine the cause of the failures. But it is not necessary to be discouraged, for frequent operations are often necessary in order to obtain a definite and good result. For, although the larger number of authors: Putti, Nové-Josserand, Froelich, and Henderson report the statistics equally discouraging, the author reports five detailed observations, of which one was of the right radius, with four cures.—*Dr. Marcel Galland, Berck-Plage.*

NEWTON MELMAN SHAFFER

Newton Melman Shaffer, who died on January 2, was the son of the Rev. James Newton and Jane Emeline Shaffer, of Newburgh, N. Y. He was born at Kinderhook, N. Y., on February 14, 1846. After receiving his preliminary training in the Hospital of the Ruptured and Crippled, 1863–68, Dr. Shaffer, in 1870, entered the service of the New York Orthopaedic Dispensary and Hospital, of which he was chief executive officer and surgeon until 1898, when he resigned. He then set to work on a plan he had in mind to establish a state hospital for the care and treatment of crippled and deformed children, and prepared a bill establishing a hospital for this purpose and secured its passage by the legislature in the year 1900.

He served as superintendent and surgeon-in-chief of the New York State Orthopaedic Hospital for Children until he resigned in 1910. After that time he served on the consulting staff.

At the time of his death he was: Emeritus Professor of Orthopaedic Surgery, Cornell University Medical College; Consulting Orthopaedic Surgeon, St. Luke's Hospital, N. Y., and to the New York State Orthopaedic Hospital for Children, West Haverstraw; also a member of the American Medical Association, The Congress of American Physicians and Surgeons, The American Orthopaedic Association, The New York State Medical Society, The New York Academy of Medicine.

In 1923 Dr. Shaffer published in book form many of his contributions to the literature of orthopaedic surgery (Selected Essays on Orthopaedic Surgery. From the writings of Newton Melman Shaffer, M.D. G. P. Putnam's Sons). These essays contain much that is of the greatest value in the present-day knowledge of pathology, though some were written half a century ago.

GEORGE B. PACKARD, SR.

George B. Packard, Sr., one of the pioneer physicians of Denver, Colorado, died in February, in Denver. Dr. Packard was born and educated in Vermont, receiving his medical education at the University of Vermont. He practiced medicine both in Hartford and New York City before going to the West. Thirty-nine years ago he established himself in Denver, and since that time has been actively engaged in the practice of orthopaedic surgery.

Dr. Packard was past president of the Denver County Medical Society, the Colorado Medical Society, and the American Orthopaedic Association. He was at one time Professor of Orthopaedic Surgery at the University of Colorado. At his death he was a member of the medical staff of the Children's, St. Luke's, St. Joseph's, and Mercy Hospitals.

PROFESSOR E. KIRMISSON

A few weeks ago there died in France, Professor Kirmisson, who for many years was Professor of Orthopaedic Surgery at the Paris Medical School.

It was my good fortune to study Orthopaedics under this gentleman, as he was kind enough to accept me as *Benevole*—or *Voluntar Artz*—in his "Service des Enfants Malades" in Paris and again at l'Hopitâl Trousseau:—hence these notes "in memoriam", on request.

The old gentleman was a striking figure in the surgical world of Paris, and he stood quite by himself at the meetings of the Société de Chirurgie de Paris.

What would we say of the surgeon, the teacher, the man, in these short notes of reminiscence?

As a surgeon: he was sure and careful; a fairly swift operator if not a brilliant one,—his technique was both painstaking and accurate—; and to those who recall his clinic a rather "noisy" operator, lacking that calm dignity of silence which he exacted from his students and onlookers and did not seem to practice himself.

He was not particularly friendly to all newcomers, but when he had convinced

himself that the visitor was earnest and well meaning he could be a most amiable host and ever ready to have the guest take of his vast knowledge of orthopaedics.

He had a temper of his own and I quite remember how he had been styled by his students "Le Bonhomme Martinet", being caricatured as holding a lash which he seemed inclined to use against both his students and patients; but beneath this was a good and charitable soul; he was always very kind to those he liked and to none more than to his "babies".

As a teacher, he was "born to the trade". His clinics were well prepared, clearly given with an admirable logical sequence which carried the mind of the listener from the tangle of varied symptoms to the final differential diagnosis, from which he drew conclusions with clear indications for practical therapeutical applications.

He delivered his clinics with gusto and at times aggressiveness, when he thought he had to fight for his ideas, always with that easy and elegant flow of language so characteristic of the French professors, which we encounter now and then on this side of the Atlantic.

Of course the long and minute training of the French school in this direction is well known and after having gone through the many stages of the *concours*, when the *agrégé* finally attains to a full fledged professorship, his training serves him well. Osler for years back has pointed to this remarkable peculiarity of the French school.

Is not the art of teaching, if not gradually disappearing, at least evolving towards a more simple, "easy going" way of teaching, requiring nowadays of us, less of a preparation for our clinical delivery and substituting general bedside remarks given out in a more or less haphazard manner. The art of the Old Masters—of, for example, the great founders of Johns Hopkins: Welsh, Osler, Halsted, and Kelly—is unhappily, to my mind, gradually vanishing away.

Professor Kirmisson was an arduous worker. Early to rise, he was early to arrive at his "Service des Enfants Malades" and was as exacting of his staff and students. Prolific he was as a medical writer. His first important contribution was the fourth volume of the "Manueal des 4 Agrégés -La Chirurgie des Membres". Still better, came from his pen in 1898 "Le Traite des Maladies Chirurgicales d'Origine Congenitale", and in 1902 "Les Difformités Acquises de l'appareil Locomoteur",—both of which still remain a source of information to every professor of orthopaedics.

Indefatigable in his professional activities, he founded in his early years, about 1890, La Revue d'Orthopédie—and later organized La Société Francaise d'Orthopédie which held a high place in France as well as in the surgical world at large.

His earnestness, his aggressiveness, his combativeness drew him into many a surgical strife, for Kirmisson held fast to his ideas and convictions, and never missed his chance of "speaking his mind".

Devoted to his work, charitable to his little suffering friends, after perhaps a gruff remark, he always had a kind touch to smooth out the anxious fear of the little ones. Devoted to his friends, he was a good soul and had a kind heart, "*un coeur d'or sous une rude main parfois*".

He has left an example of a well filled life, of devotion to duty, of unbounded devotion to the miseries of young life, of a leading surgeon and a still greater teacher,—all of which will keep alive his memory in the Annals of Orthopaedics.—*E. St. Jacques, M.D., Montreal.*

Current Literature

TRAITEMENT DES FRACTURES PAR LE PRATICIEN. By Dr. Étienne. Preface by Professor Jeanbrau. Paris, Masson et Cie, 1927.

The author has presented a book full of practical suggestions and information particularly designed for the use of the practitioner and of those who are obliged, because of their isolated environment, to treat the various medical and surgical conditions which come to their care. He speaks from a large experience, much of which was obtained under these conditions, and the author evidently appreciates the difficulties under which the practitioner is obliged to pursue his work.

He considers in his first chapter the etiology as well as the anatomy and the pathology of fractures in general; in the second the therapeutic indications, with a discussion of the general methods of treatment and general technique; in the third, which is the most important and which comprises the larger part of the book, he describes the various types of fractures which ordinarily come to the surgeon and practitioner, and makes a special study of these from the anatomo-pathological point of view. He also describes the various forms of apparatus which may be used in these types of fractures, and also the details of their application. The last chapter is devoted to the separation of the epiphyses and open fractures.

The book is excellently illustrated by diagrams, and the illustrations of the x-ray by diagramatic drawings of the ray, give the student a far better point of view than the photograph of the x-ray itself, since the relation of the various parts can be so definitely indicated.

This book has a rôle to play among those for whom it was intended.

POLIOMYELITIS: WITH ESPECIAL REFERENCE TO THE TREATMENT. By W. Russell MacAusland, Philadelphia, Lea and Febiger, 1927.

This monograph of 402 pages is divided into two parts. Part I consists of eight chapters dealing with Epidemiology, Etiology, Pathology, Symptomatology, Classification of Types, and Diagnosis and Prognosis. Part II takes up treatment in six chapters under the following headings: General Treatment, Treatment of the Lower Extremities, Treatment of the Upper Extremities, The Restoration of Muscle Power, The Surgical Treatment of Paralysis, Apparatus and Plaster.

The book has been well edited and is remarkably free from the usual errors of an initial print. The author's objective, as set forth in the preface, in establishing a comprehensive account of the disease, is fulfilled in Part I. The chapter on Epidemiology is especially good.

The arrangement of Part II in dealing with all phases of treatment leaves much to be desired. Early operations are quite clearly discountenanced by the author in some sections, but in others he is not definite, and the unqualified surgeon is likely to seize upon this part of the text as authority for surgical experience.

It seems doubtful whether anyone could so arrange this part of the subject matter as to entirely meet the requirements of general practitioners and orthopaedic surgeons. It is also improbable that a work of this sort would be free from such debatable points as operations of choice, age factors, etc.

In reference to stabilizing operations on the foot, no one who has mastered the technique of Hoke's operation will be discouraged by the author's comment, nor greatly impressed by his modification, as depicted on page 341.

On the whole, however, Dr. MacAusland's book is quite worth while.

EXPOSURES OF LONG BONES AND OTHER SURGICAL METHODS. By Arnold K. Henry, M.B., B.Ch. Univ. Dublin, F.R.C.S.I. Foreword by Sir W. I. deC. Wheeler (Dublin). New York, William Wood and Co., 1927, $3.50.

The author has presented to the profession a book of valuable information to all who may have occasion to expose the shafts of long bones and to use some of the more difficult approaches to the inaccessible deep structures. The need of using the intermuscular routes to avoid injury, not only to the muscles themselves, but to the nerve and nutrition supply, is shown. The technique to accomplish this is given. He also shows the injuries incident to some of the popular avenues of approach, so often chosen, presumably, because of an easier or more superficial access. The details of the surgical technique of his methods are clearly presented, and are accompanied by excellent drawings of the various stages in the operation, and the illustrations include cross-section views.

A short chapter is devoted to the exposure of the plantar region of the foot. The author has devoted the latter part of the book to the discussion and details of his approach in operations for tying the vertebral and subclavicle arteries; also for the removal of the pituitary gland.

The surgeon who desires real information on this special operative procedure will appreciate this book.

THE PREVENTION OF PREVENTABLE ORTHOPAEDIC DEFECTS, WITH SPECIAL REFERENCE TO THE SPINE AND THE FEET. By S. C. Woldenberg, St. Paul, Bruce Publishing Co., 1927.

A well printed little book of 120 pages. Dr. Ridlon's plea for tolerance in the foreword makes it difficult to dispose of the work summarily. The text contains less than might be expected from the ambitious title, but the size of the volume allows only a brief mention of the various subjects considered in it. There are many valuable suggestions which might be grouped under another title, but one should welcome all information on this important subject of the prevention of orthopaedic defects and preventable deformities. The picture of Dr. Ridlon is excellent.

THE YOUNG MAN AND MEDICINE. By Lewellys F. Barker. Vocational Series edited by E. Hershey Sneath. New York, MacMillan Co., 1928. Price $2.50.

A book for young men considering medicine as a possible life's vocation.

Not an easy book to summarize, so competent, so encyclopaedic is it.

Not easy to criticize save by general approbation, which helps so little.

In these days when society is becoming so crystallized, vocation so much a matter of fixed and arranged education, life no longer a matter to be faced gaily, giving an open hand to the passing chance, but something to arrange in order from childhood, we must have vocational study and vocational guidance. And for this we must have information such as is here presented. And how better may a lad learn what the medical profession means and may mean to him than by such a presentation of what it has stood for, and does stand for, what duties and opportunities seem likely in prospect!

Dr. Barker has given an account of all this, not only accurate in historic detail, lucid and informing as to trends and tendencies, but oddly enough of engaging interest.

Again, in considering the conditions of practice, whether from the point of view of the practitioner or the specialist, teacher or investigator or public servant, we have the same clear, fair point of view, the same broad knowledge.

Frank consideration of what medicine means as a business,—or rather as a way to independent livelihood,—is in order here, and is considered; but especially commendable is the insistence on business responsibilities, on the *duty* of being decently paid according to deserts, so that the doctor may be a proper citizen and take his proper place in the society of his community.

Again the insistence on the duty of participation in community interests, in the affairs of our now complex society—and again a wise tempering of this advice—a warning against spreading out too thin in non-professional works. Timely advice not often heard.

Then we come to the question not of the profession the young man is inspecting, but of the young man himself.

And this is perhaps the best of the book. It must be read to learn more than any of us have known,—far less formulated, as to just why one boy should consider himself after self-examination a likely surgeon in prospect or not likely to flourish in surgery, or perhaps to be a good health officer, fitted better for research than practice,—or perhaps at worst, or best, really bred and reared to be a truly good manufacturer or railroad man.

An able, frank, useful presentation is this, and worth reading by many who have long since chosen and are living with and by our profession.

TREATMENT OF OSTEOMYELITIS AND OTHER INFECTED WOUNDS. By H. Winnett Orr. Chicago, Surgical Publishing Co., 1927.

Not conventional research, perhaps not research work at all.

A challenge, rather, to outworn, encrusted habit and custom,—a challenge, intelligent, well-considered, backed by experience, and with some array of facts and cases to support it.

A timely challenge;—and on the whole, Dr. Orr has made his point.

Easy to tear holes in his presentation, better to see what he has actually shown us.

He challenges the value of antiseptic dressings:—this is of course correct (save for Dakin irrigations): we have long known it but not acted on our knowledge.

He challenges the value of our routine drainage: and in so far as concerns bone and joint surgery, he is once more quite right, though other factors must be taken into account in draining belly or thorax.

He challenges our frequent change of dressings as useless, often harmful, and once more he distinctly makes his point.

He believes wholeheartedly in absolute rest to favor resolution and repair. Again he is right, so far as acute cases are concerned, at least. In the subacute conditions not all will agree with him and rest *may* be carried to very harmful extremes.*

Just the same the main points in *destructive* criticism will stand.

We have been guilty of futile use of antiseptics in infected wounds.

Our ideas of drainage have been a matter of habit not a result of study.

We have been guilty of harmful meddling and redressing wounds everlastingly to no good purpose.

We have often forgotten the rôle of rest in favoring resolution and repair,—and in checking the spread of infection.

Now as to the *constructive* side of his work,—one must analyze a bit closely, and separate facts from theories not necessarily acceptable.

First as to osteomyelitis,—for oddly enough it is as a theory of osteomyelitis treatment, not as a contribution to the handling of sepsis as such, that his work has been discussed,—first then as to osteomyelitis.

There are no cases cited of the severer type of hematogenous osteomyelitis with massive death of bone; there are only two cases of primary operation on osteomyelitis (Cases 3 and 6). His Case 2 and that of the nurse were neglected cases that did well after proper surgery. Cases 1 and 5 were infected fractures.

Case 4 does not belong in a discussion of infections, but under the caption of direct fixation and open treatment in compound fractures.

What can we make of these cases or of the tables appended?

There is today no disagreement among experienced men that the treatment of acute osteomyelitis is *radical* opening and rest.

*It is of no use to cite Judson as authority in this. We have seen and digested a good deal since Judson wrote in 1886.

No question that the quoted case of McNamara is all that is wrong (whether in 1887 or 1928), no question that Orr's Cases 3 and 6 were wisely treated and both did excellently well. Why? No factor differing from usual treatment except a non-irritating form of drainage and a studied non-interference with the wound.

In the secondary operations (No. 2 and the nurse, and the infected fractures) results were admirable—but wisely judged surgery must take credit for much. Again more careful non-interference, and rest more insisted on than is common.

The reviewer is very thoroughly in sympathy with non-interference, and for a dozen years has filled bone cavities (sterilized with carbolic and alcohol) with wax or vaselin and let them severely alone, and, despite the fact that such sterilization can be but partial, the results have been almost uniformly good.

He feels that the avoidance of air-drying and chilling, the prevention of re-entrant infection, and the presence, facing the cleaned surfaces, of clean non-irritant vaselin instead of a bacterial poultice of pus and gauze all have their share in the result, and is in no disagreement with Dr. Orr in all this.

In this class of cases, however, rest seems not to be of great importance.

In Dr. Orr's more acute cases he seems to show that vaselin gauze, properly, lightly, packed, does not interfere with drainage. Certainly, if this is so, it is a proper dressing and he is right as to infrequent dressings, and, of course, right as to absolute rest in such cases.

There is danger that his booklet may be interpreted as telling us that poking a hole and putting in vaselin gauze and doing nothing forever after is adequate handling of bone infection.

That way lies disaster!

And yet in what he means and says he is right.

Adequate, radical drainage, or, later, adequate careful debridement with attempted sterilization, packing (loosely) with the protecting, non-plugging, clean vaselin gauze,—full rest,—infrequent dressings,—these are all wise and proper things for us to do in infections, particularly in bone.

We owe Dr. Orr a very real debt for his challenge—for waking us up.

CENTENARY NUMBER OF THE GLASGOW MEDICAL JOURNAL—Vol. XXVII, No. 2, February, 1928.

A hundred years of Medical Journalism would afford, in any part of the world, an opportunity to set forth many things of great interest, but when this opportunity occurs in Scotland where medical history has been replete with distinguished teachers and practitioners it would be a difficult task to properly summarize the events and suitably characterize the individuals. The Glasgow Medical Journal has been published, with the exception of a break of twenty years, from 1833–1853, a part of the time as a quarterly but most of the time as a monthly. This Centenary Number has a most interesting bit of medical history in the article entitled "An Early Medical Journal", in which it is pointed out that the first medical journal ever published was of French origin and was called "The new discoveries in all branches of Medicine". It was printed in Paris in 1679 by Nicholas de Blegny and was an annual, continued for three years. The second, still another French publication, came out in 1683 and was called "The Journal of Medicine", while the third was styled "Medicina Curiosa" and was the first medical publication in Great Britain.

In the century covered by the life of this journal "much water has run under the bridge". In therapeutics many new synthetic remedies have been introduced which have benefited sufferers from rheumatism (the salicylates), angina (amyl nitrate), and syphilis (arseno benzol). During the period numerous additions to the instruments of precision have been made to the armamentarium of the physician. The list of those who have made contributions to the art, confining one's survey to only a few of those who have made British Medicine famous, should include the names of Lister, Simpson, Gowers, Paget, Macewen, Horsley, Sharpey, and Mackenzie.

This Centenary Number is to be commended to all desirous to obtain, in small compass, a review of a very important epoch in the History of Medicine in Scotland. The Glasgow Medical Journal had no small part to play in the events of the time, not only in recording them but in actually shaping them.

CONVALESCENCE: HISTORICAL AND PRACTICAL. By John Bryant. New York, The Sturgis Fund of The Burke Foundation, 1927, $5.00.

This volume is composed largely of a series of articles previously published by the author on the subject of convalescence—a phase of medicine which, he believes (and with justification), has always been neglected. There are chapters reviewing the literature and actual work done in this neglected field from the seventeenth century to the present time. Particular attention is devoted to the Burke Foundation of NewYork, the Cleveland Hospital and Health Survey, and to the convalescent work in the United States Army during the World War.

In his preface, the author states it as his aim to have the volume a "reasonably complete source book". In attempting to make it such he has gone into infinite detail; repetitions are frequent; but it is undoubtedly complete and will be useful as a reference book. The reader desirous only of a broad general idea of the subject of convalescence will find much of the book uninteresting, and the chapters on United States Army work and on Surgical Convalescence will be sufficient for his needs.

The latter chapter, giving clearly and convincingly the author's views concerning the problem of the post-surgical case, seems easily the most valuable part of the book. It can be read with profit by any clinician or health worker, and is commended to all those interested in medicine as a whole.

DE BEHANDELING VAN BEENBREUKEN MET HET UITGEBALANCEERDE ZWEEFREKVERBAND UIT DE KLINIEK V. Prof. Dr. W. Noordenbos door, H. P. Wijnen. Amsterdam, Scheltema & Holkema.

(THE TREATMENT OF FRACTURES WITH BALANCED SUSPENSION TRACTION. From the Clinic of Prof. Dr. W. Noordenbos. By Dr. H. P. Wijnen.)

The suspension traction treatment of fractures devised by a Dutch surgeon, named Metz, was introduced by the Dutch ambulance in the Balkan War, and the appliance he used has since gone by the name of "Balkan frame".

Noordenbos has modified Metz's dressing by using two sticks instead of one: one for the thigh, and one for the lower leg. Screw rings take the place of pulleys. The wooden frame is replaced by gas-tube construction; and plaster traction by the Steinmann pin, as is used in the United States (*cf.* Scudder, The Treatment of Fractures). Weights provide the equipoise.

In compound fractures antitetanus serum is injected and the wound cleaned with hydrogen peroxide under general anaesthesia. Five per cent. picric acid is applied both inside and around the wound. Lacerated parts are removed.—*W. Mol, M.D., Leiden, Holland.*

SPORTSCHADEN AM BEWEGUNGSAPPARAT. By Prof. Wilhelm Baetzner. Berlin, Urban and Schwarzenberg, 1927.

"Sport damage of the Locomotor Apparatus" is the term the professor reserves for injuries to the bones, joints, and muscles, manifested by exostosis and cartilage injury as seen in the x-rays and muscle rupture and tendon detachments.

The professor is himself an athlete. He has observed cartilage destruction in his own joints by means of the x-ray; the discovery was quite accidental as he suffered from no clinical symptoms. The article contains many cuts of x-rays. They show marked exostosis in the elbow, knee, and shoulder joints; they are at the insertion of tendons and are in the form of hooks and spurs. Some of the pictures resemble cases of multiple loose bodies or osteochondritis dissecans.

In the summary the author states that the study was made at random and that it represents but a small proportion of the sport devotees. He does not give any figures. He selects indiscriminately a professional boxer, football or tennis player, those who are young and in sports three or four years and have no clinical symptoms of muscle or bone damage. The x-rays reveal the bone and cartilage changes as mentioned above. He was surprised at the relative frequency of these findings in the absence of clinical signs.

The *Journal* wishes to acknowledge the receipt of the following sent to the Editorial Department:

Studies in Medicine, University of Iowa Studies, Iowa City, Iowa, Vol. III, No. 1, 1927.

Boletin de la Sociedad de Cirurgia de Chile, Santiago, Chile, Vol. V, Nos. 16, 17, 18, 1927.

Bulletins de la Société de Pédiatrie de Paris, Paris, Masson et Cie, Vol. XXVI, No. 1, Jan. 1928.

Revista de Especialidades, Buenos Aires, Asociación Medica Argentina, Vol. II, No. 5, 1927.

Revista de la Sociedad de Medicina Interna y de la Sociedad de Tisiologia, Buenos Aires, Asociación Medica Argentina, Vol. III, No. 4, 1927.

Paris Médical, Vol. XVII, No. 53, December 31, 1927. Special issue devoted to the life and work of the late Professor Augustin Gilbert.

The End Results in Albee's Operation for Splinting Vertebrae. T. Wingate Todd. *Ann. Surg.*, LXXXVI, 837, Dec. 1927.

This is the report of an autopsy on a case which has been operated upon by the Albee method. The graft had evidently been in place a long time. It still persisted and showed good fusion between two vertebrae.—*F. G. Hodgson, M.D., Atlanta, Ga.*

Formation of Radius Congenitally Absent. Fred H. Albee. *Ann. Surg.*, LXXXVII, 105, Jan. 1928.

This is a report of a case seven years after an operation by Albee. A tibial graft was implanted into the radial side of the carpus below and into the shaft of the ulna about the junction of the lower and middle thirds. After seven years the graft had greatly enlarged due to use and the patient could play tennis, drive an auto, ride horse-back, paint etc. He does not advise the operation before the child is three years old. Other cases are mentioned in which the author has obtained great improvement in the deformity and the function.—*F. G. Hodgson, M.D., Atlanta, Ga.*

The Use of a Flexed Plaster Spica Case in the Treatment of Hip Fractures. George Albert Moore. *Ann. Surg.*, LXXXVII, 111, Jan. 1928.

The various methods of treatment of hip fractures are mentioned. The author applies a plaster case in the position of flexion ninety degrees, abduction and internal rotation. The knee is flexed ninety degrees and the foot enclosed. Ether, morphin, and scopolamin or spinal anaesthesia is used. The day following, the patient is allowed to sit up on the edge of the bed with the feet on a stool, and a back rest. Most patients are allowed to go home in two or three weeks. The case was usually removed at the end of eight weeks in the earlier cases, but now fixation in the medial fractures is kept on for twelve weeks and sometimes sixteen weeks, if well borne. Patient is kept in bed two to six weeks longer, using massage and active motion. This is followed by using a walking caliper brace. Full weight-bearing only after eight to twelve months. Four illustrative cases are reported.—*F. G. Hodgson, M.D., Atlanta, Ga.*

THE RELATION BETWEEN LENGTH AND THICKNESS OF THE METATARSALS IN THE NORMAL AND PATHOLOGICAL POSTURE OF THE FOOT. (DEUTSCHLANDER'S DISEASE.) M. Hackenbroch. *Arch. f. Orthop. u. Unfall-Chir.*, XXV, 440, Oct. 25, 1927.

The thickening of the metatarsal bone in Deutschlander's disease is explained by the author as having resulted from overactivity of the second metatarsal. He has observed similar thickening of metatarsal bones after operative interference on the metatarsus, with resulting shortening of one or more metatarsal bones; Hueter's (Mayo's) operation in halux valgus, operation for the correction of pes cavus; also after functional shortening and toe amputations. An alteration of the dynamic-static demands upon the metatarsus takes place and throws inadequate functional requirements upon one or the other metatarsal bones, thus the thickening of the second metatarsal in Deutschlander's disease is explained.—*A. Gottlieb, M.D., Los Angeles, Calif.*

ANKLE FRACTURE WITH CHIPPING OF THE POSTERIOR TIBIAL BORDER. Waldemar Hohenbalken. *Arch. f. Orthop. u. Unfall-Chir.*, XXV, 478, Oct. 25, 1927.

In ninety-eight malleolar fractures, the author found in sixteen instances the posterior border of the tibia chipped off: in conjunction with the fracture of the external malleolus, five times; with fractures of both malleoli, nine times; and with both malleoli fractured and the foot posteriorly dislocated, twice.

Treatment: Bloodless reduction offers good results and should therefore always be attempted before operative reposition is instituted. After closed reduction, a plaster cast is applied from the toes to below the knee.—*A. Gottlieb, M.D., Los Angeles, Calif.*

OPERATIVE TREATMENT OF SERRATUS MUSCLE PARALYSIS. (SCAPULA ALATA.) C. Th. Willich. *Arch. f. Orthop. u. Unfall-Chir.*, XXV, 516, Oct. 25, 1927.

In serratus paralysis one can readily observe that a passive fixation of the scapula against the thorax favors a partial restoration of motion of the humerus. For this reason operative procedures consisted in fixing the scapula to the thorax. Unfortunately many methods have not lead to permanent results. The author's modification of the fixation operation consists of the following:

Through a fifteen-centimeter incision, the vertebral margin of the scapula and spine are exposed. The scapula is drilled through, and through the drillhole a wig of fourfold thick silk is drawn and fixed to the supraspinal or infraspinal ligament between the seventh and eighth spinous processes. The silk wig is tunnelled under the trapezius and latissimus dorsi muscles. Now, a piece of fascia lata three centimeters by fifteen centimeters is obtained and carried through the drillhole of the scapular angle. This fascial strip is wound around the masses of the latissimus and trapezius muscles, thus encircling them and drawing them towards the scapular angle. Further, the ninth rib is exposed, and the inferior angle of the scapula is attached to it in the posterior axillary line. The incision is closed. The arm is placed in right angle abduction, and left so for two weeks. Three weeks after the operation gradual motion is commenced. The author claims very good results six months after the operation.—*A. Gottlieb, M.D., Los Angeles, Calif.*

THE STABILIZATION OF THE FLAIL LEG. H. Tyrrell Gray. *British J. Surg.*, XV, 390, Jan. 1928.

Arthrodesis of the knee is advocated in cases of extensive infantile paralysis of the lower limbs. At the end of two years after the onset of the paralysis, cases are selected in which there has been no return of muscle power or where the patient is unable to bear weight without heavy braces.

A narrow bone graft three inches long is taken from the crest of the tibia. The knee is opened, the cartilage is removed from the tibia, femoral condyles, and patella and the semilunar cartilages are excised. A hole is then drilled through the epiphyses of the tibia and femur and the graft inserted into the diaphyses. The leg is put in plaster for two months. In most cases the ankle joint has been arthrodesed also.

Case reports are given of nine cases. Ankylosis took place in each case. The results were satisfactory except in two cases where there was extensive oedema of the extremity. In one this cleared up after several years, but a marked genu valgum appeared. In the other the swelling has remained. The author does not think that the damage to the epiphyses from the graft is serious enough to consider it.

ARTHRODESIS. W. Rowley Bristow. *British J. Surg.*, XV, 401, Jan. 1928.

The author calls attention to an increase in the number of arthrodeses being done since the War. The indications are pain and loss of function. The causative agents are usually arthritis, trauma, and paralysis.

While wholesale arthrodesis of tubercular joints is not advocated, he believes it should be done if the bone is involved, chiefly in the knee and hip joints.

The technique of extra-articular and intra-articular arthrodesis is reviewed. Arthrodesis of the ankle is advised for traumatic arthritis arising from a malunited ankle joint fracture. The technique of Wilson in subastragaloid arthrodesis for fracture of the os calcis involving the joint, of Smith-Peterson in sacro-iliac arthrodesis, of Hibbs in spinal fusion are approved.

Reconstruction of the hip is preferred to ankylosis. The operation is simpler and the period of fixation is less. The procedure described by Hoke and by Dunn is the one employed in the paralytic deformities of the foot.

TREATMENT OF ANKLE AND LEG FRACTURES BY THE "DELBET" AMBULATORY PLASTER SPLINT. E. Leslie Robert. *British J. Surg.*, XV, 414, Jan. 1928.

This method is used in ankle fractures of abduction and adduction etiology with lateral displacement of the astragalus, and in malleolar fractures with anterior or posterior displacement of the astragalus. It is also used in closed fractures of the tibia, the torsion variety of both bones fracture, in transverse fractures of both bones, and in some cases as a secondary splint for open fractures. The advantages of the method lie in the fact that weight-bearing may be started within two or three weeks, active knee and ankle motion is possible, and the patient may return to work in this splint in from four to six weeks.

The Delbet plaster is prepared by using numerous layers of book muslin cut in the proper shape and dipping them in plaster cream before application. The leg is placed on a large board. Two splints are applied to the sides of the leg below the tibial tubercle, coming down below the malleoli. A third plaster encircles the first two at the lower border of the tibial tubercle. The fourth one fits snugly behind the heel and crosses over the crest of the tibia. The skin is greased before the application. Strips of calico bandage are placed over the plaster to hold them in place while drying.

Recent ankle fractures are treated by a box splint with elevation of the foot on pillows, x-rays, a general anaesthetic, and reduction by manipulation within forty-eight hours, with application of the Delbet splint.

Of twenty-four recent ankle fractures treated in this way, the average date of commencement of walking was fourteen days, of removal of plaster and cessation of all treatment fifty-two and two-tenths days, of abandoning sticks, (21 cases) thirty-five days. The dates of returning to work are not given. There were five poor results.

In fourteen cases of leg fractures treated by the Delbet method, the average period of treatment was sixty-two days.

OSSIFYING HEMATOMA. James B. Bullitt. *California and West. Med.*, XXVII, 508, Oct. 1927.

A boy of eighteen developed a hard swelling in the lower third of his thigh, three weeks after injury in a football game. Roentgenogram showed a lightly calcified mass three and five-tenths by six centimeters in size attached to the femur, but slightly movable. The mass was removed nearly three months after the injury and was found

to be made up of bone. Roentgenogram, four months later, showed no recurrence of the growth.

The question arises whether this is a myositis ossificans or an ossifying hematoma. The former term does not seem well chosen because, in such cases, the muscle takes no part in the process but rather is passive. The bony growth proceeds in blood clot and goes in between muscle planes, not into the muscle substance. Whether the bone tissue is derived from displaced periosteum or whether it is the result of a traumatic aseptic myositis, is still an unsettled question, with the latest investigations favoring the latter theory. Numerous observations have shown that connective tissue can form bone, as observed in repair of fractures.

This paper includes a very able discussion from an embryologic point of view, on the formation of these growths and the weight of evidence seems to be that the periosteum does not play a necessary part in them.—*W. A. Clark, M.D., Pasadena, Calif.*

Some Aspects of the Problem of Joint Tuberculosis. Russell A. Hibbs. *Can. Med. Assn. J.*, XVII, 1514, Dec. 1927.

An end result study was made of seventy-seven cases of knee joint tuberculosis which had been under observation for from five to fifteen years. In thirteen per cent. an incorrect diagnosis was made. Of the sixty-seven patients remaining, seven died from other forms of tuberculosis, forty-three of the knees became quiescent, sixteen became active, leaving only twenty-seven inactive cases. Of the twenty-seven, five have stiff joints, twenty-two have varying degrees of motion, but all with marked limitation and seriously crippled joints. Sixteen of them subsequently had a fusion of the knee by operation and have remained free from symptoms. Indeed, not a single case of recurrence after this operation has been seen.

The average length of conservative treatment in these seventy-seven cases was six and one-half years and the average period of observation fifteen years.

The results in the conservative treatment of tuberculosis of the hip are still worse. From 1904 to 1921, 208 such cases were treated. Errors in diagnosis were made in forty-six cases or twenty-two per cent., leaving 152 who probably had tuberculosis. Of this number 150 were observed for from three to fifteen years. Thirty-six of this number or twenty-four per cent. died, twenty of these from tuberculosis. Of the remaining 114, seventeen are still active, two are quiescent with probably free motion, forty-one are quiescent with marked limitation of motion and varying degrees of deformity, fifteen patients had relapses after quiescence of from one to nine years. The average duration of treatment in these 114 cases was seven and three-tenths years. Nine patients had operations for hip fusion after disease lasting for seven to twenty-five years. A high percentage of cure has followed this operation.

More or less the same situation holds with regard to spines. For upper limbs the outlook is better, though mobility is seldom conserved.

This study offers convincing evidence that our conception of the cure of tuberculosis must be revised and our methods of diagnosis perfected.

Most of the recorded studies of end results are unreliable because of errors in diagnosis and failure to observe individual cases over a long period of time.

The exponent of any method of treatment must first prove the pathology by laboratory test and the results by observation of the individual case over a long period of time.

Many so called quiescent cases have been found at operation to have active disease; the condition of the general health is no guide. Many of the cases have been exposed to the sun's rays for about eight months of each year.

There is no evidence yet to prove that heliotherapy has any particular influence on the progress of the disease, and there is grave danger that the belief that it does so, which is so generally accepted, may delay the proper study of this disease for another decade.

This is a paper which gives one "furiously to think".—*A. Gibson, F.R.C.S., Winnipeg, Man.*

INFECTIONS OF THE HAND. L. H. McKim, *Can. Med. Assn. J.*, XVIII, 17, Jan. 1928.

The object of the paper is to outline the treatment of certain infections of the hand which are most advantageously treated without the use of wet dressings.

The incision. This must be adequate. It is bad policy to make longitudinal incisions on the flexor or extensor surfaces. Incisions should correspond more or less with the natural flexion creases of the hand. Pressure-bearing surfaces should be avoided where possible. Nerve supply and blood supply should be preserved.

The old median incision for tenosynovitis transgresses nearly every one of these principles. Flexion of the fingers from contracture may result fron longitudinal incision of the palm even where the tendon sheath is not involved. This is due to bunching up of the fibers of the palmar fascia at the sides of the incision.

The technique of the incision. General anaesthesia is preferable.

The operation should have a bloodless field.

The incision should be a correct and adequate one.

All partitions in the cavity should be broken down and all necrotic material removed. The cavity should be dehydrated with alcohol and packed tightly with gauze soaked in liquid paraffin.

After treatment. Morphia may be necessary for the first twelve hours.

All ambulant cases should have a sling, severe cases should rest in bed.

If there is much oozing, the large dressing may be removed on the first or second day and a fresh one applied, but the gauze packing must not be removed from the wound itself before the fourth day. If removed too soon, bleeding with reinfection of the clot is certain to occur. When removal is carried out at the proper time, the bottom of the cavity will be found to be covered with healthy granulations.

The utmost care must be exercised to prevent reinfection of the wound. No watery solutions should be used, only alcohol or liquid paraffin. If any slough is seen when the packing is removed, the cavity is again dehydrated and once more packed.

Usually not more than three or four dressings are necessary. If the wound is clean it should be poured full of liquid paraffin and a dry dressing applied. In a few days the edges may be strapped together. Baking may be begun after the first dressing. Early passive movements should be used in tenosynovitis. Hot baths must not be used until the skin wound is healed.

Details of this treatment in paronychia and whitlow are given. Prevention of contracture deformity is best obtained by early attention to the true functional position.—*A. Gibson, F.R.C.S., Winnipeg, Man.*

SOME DISABILITIES OF THE SHOULDER REGION. A. Gibson. *Can. Med. Assn. J.*, XVIII, 30, Jan. 1928.

The purpose of this paper is to sound a note of discontent with the results obtained in treatment of shoulder injuries. The surgical anatomy of the part is discussed at length and a number of lesions are mentioned.

Codman's opinion is quoted that "if a man cannot actively abduct his arm, and especially if after you have abducted it for him, he cannot hold it at the horizontal against moderate downward pressure, you may be sure enough of the diagnosis to justify exploratory incision of the bursa".

The work of Meyer is described in regard to destruction of the long head of the biceps, a condition largely overlooked. This lesion was attributed by Meyer to occupational stresses, especially with the arm abducted and rotated externally.

ARTERIAL PERFORATION BY AN EXOSTOSIS. Nové-Josserand. *Lyon chir.*, XXIV, 234, 1927. Abstracted in *Edinburgh Med. J.*, XXXV, 37, Jan. 1928.

A female, aged eleven years, six months, whose father and brother had osteogenic exostoses, fell at play, and several companions falling on her, she felt sharp pain at the left knee.

She was able to walk but limped. One month later the knee was found flexed to 160 degrees and seemed normal. Adjacent part of thigh showed two typical exostoses. There were other exostoses about other joints in the body. The injury was diagnosed as simple contusion and no treatment was adopted for two and one-half years. From time to time there was pain and fulness in the limb, relieved by rest. Suddenly the pains became severe, the temperature rose, and the distal end of the femur formed a considerable tumor. This swelling did not pulsate. X-ray showed condition not a sarcoma, but exostosis had increased in size. After three days pain suddenly ceased, ecchymosis appeared on inner side of thigh and patient could walk with little pain. The improvement was only temporary. A few days later symptoms returned, fluctuation in the tumor suggested a hematoma. Then matters settled down as before for a month, and reappeared. Three weeks later, operation was performed.

The femoral artery was temporarily ligated at the apex of the femoral triangle, and the tumor was then laid open and found to consist of a mass of partially organized clots. On relaxing the femoral ligature, blood flowed from the upper part of the cavity and was found to correspond with a tear about one centimeter in length in the femoral artery. The artery with the vein was involved in a matrix of hard tissue, from which it was inadvisable to isolate it, and so the whole was included in a ligature. Projecting from the exostosis was a sharp splinter of bone which had obviously wounded the artery. A subsequent hematoma formed a fistula which persisted two months, but ultimate recovery was quite satisfactory.

Injury to blood vessels by osteogenic osteomata is not common. Desjacques has found eleven cases reported. In these the axillary artery was affected once, the femoral twice, the popliteal five times, and the peroneal artery once.—*A. Gibson, F.R.C.S., Winnipeg, Man.*

Patellitis. Stolz, Meyer, and Weiss. *Bull. et Mém. Soc. nat. de chir.*, Paris, LIII, 847, 1927. Abstracted in *Edinburgh Med. J.*, XXXV, 81, Feb. 1928.

In 1921 a condition of the patella was described in children which recalls appearances sometimes seen in the tarsal navicular and the carpal lunate of children and adolescents. It is probably the same condition described by Mouchet in 1919 as a growth osteitis of the patella. Stolz, Meyer, and Weiss have described a new case, and have coined the name "patellitis".

Male, twenty-two, fell on the left knee. This was followed by considerable swelling, partially allayed by rest in bed. Seven weeks after injury, the joint was still painful and swollen; there was some thickening about the parts, and the quadriceps was atrophied. Flexion of the knee was restricted. The x-ray of the patella showed the shadow dappled, certain zones being unduly dense, others unduly light, giving a curious appearance of fragmentation, so that the distal pole of the patella appeared detached from the body of the bone.

A small portion of the patella was removed by operation and the marrow in the decalcified area was found to be very red and congested, and to have lost its normal yellow appearance. Bacteriological examination was negative. Histologically the bone was rarefied, the bony cortex was thin and very irregular, there was evidence of bone-cell activity and a tendency to replacement of bone by fibrous tissue.

Hypervascularization, rarefaction and condensation succinctly describe the features. Four months later x-ray showed the patella slightly deformed and irregular on its superficial surface and with one or two detached bony foci at its distal pole.

As in the similar condition in tarsal, carpal, and sesamoid bones, the initial factor seems to be trauma.—*A. Gibson, F.R.C.S., Winnipeg, Man.*

Localized Osteodystrophia Fibrosa. W. Dega et J. Zeyland. *Lyon chir.*, XXXIV, 377, 1927. Abstracted in *Edinburgh Med. J.*, XXXV, 81, Feb. 1928.

Fibrous osteodystrophy is not a clinical entity, but may occur around neoplasms of bone, in the neighborhood of old osteomyelitis, in Kahler's disease, congenital pseu-

darthrosis of the tibia, etc. A case is recorded of its occurrence in the head of the first metatarsal in association with hallux valgus in a man aged thirty-three. The valgus was bilateral, but the osteodystrophy only on the right side.

After excision of the head, the periosteum was found to be thick and dense. The defective areas were well defined and lined with flattened bone-cells. The bone marrow appeared fatty and in the spaces had become fibrous. Phagocytic osteoclasts occupied the lacunae. The osseous trabeculae were disappearing and the spaces filled with dense homogeneous connective tissue. Collagen fibers were arranged in whorls and in places blood pigment was present. The smaller vessels showed thickening of their walls.

The most striking feature was the vascular lesion. The changes in the smaller arteries seem to provoke dilation and engorgement of the capillaries. It is a local, not a general affection.—*A. Gibson, F.R.C.S., Winnipeg, Man.*

THE RESULTS OF THE TREATMENT OF PATIENTS SUFFERING FROM CHRONIC RHEUMATISM OF THE JOINTS, AT THE HEALTH RESORTS OF THE BOARD OF PENSIONS. G. Kahlmeter. *Hygiea.* Part 13, 1927.

The control examination of 975 cases was performed by the chairman of the boards of pensions of the different districts (local representatives) being asked about the condition of health of the former patients, and how far they were *able to support themselves* from their discharge down to the date of the control examination. The basis of the investigation has thus been the capability of the person in question to support himself, which is also most important from the point of view of the economy of the state. Thus they have tried to get an idea of the recovery of the patient with regard to function, not with regard to pathological anatomy.

The cases have been divided into three groups: (a) *infectious arthritis* comprising partly the cases of chronic arthritis secondary to acute polyarthritis, and partly subchronic cases running with fever; (b) *primary chronic polyarthritis* running without fever; (c) *osteo-arthritis* (arthritis deformans). (The kind of treatment given to the patients is not mentioned but has probably been chiefly physical therapy.)

1. At the time of the control examination at the end of 1925, more than sixty-two per cent. out of 975 cases, treated during the years 1915–1923, were able to work enough, so that they could support themselves wholly or partly.

2. Among the different kinds of arthritis, the infectious arthritis showed much better results than the primary chronic polyarthritis and the osteo-arthritis, which both showed about the same results.

3. Within the primary chronic group there were nearly twice as many women as men; within the group of osteo-arthritis there were more men than women; and within the group of infectious arthritis about the same number of both sexes.

4. The results are altogether better for men than for women, particularly within the primary chronic group.

5. Among the cases of infectious arthritis more than eighty-five per cent. had begun before the age of forty, and among the cases of primary chronic polyarthritis only fifty-six, or eight per cent., had begun before that age. Among the cases of infectious arthritis the results are evidently better for those who have contracted the disease before the age of forty, but among the primary chronic cases there is no considerable difference.

6. It is notable that the result of the treatment is much better in the cases where no dental changes are present than in those where such changes are indicated. Disease of the heart is noted in thirty-seven per cent. of the cases of infectious arthritis, but only in one and one-tenth per cent. of the primary chronic cases.

7. The shorter the duration of the disease, especially the invalidism before the beginning of the treatment, the better the result.—*H. Nilsonne, M.D., Stockholm, Sweden.*

KLIPPEL-FEIL'S SYNDROME AS ILLUSTRATED BY TWO CASES. Harald Nilsonne. *Hygiea.* LXXXVIII, Part 21.

Two cases of Klippel-Feil's syndrome are reported. Girls of two and four and one-

half years of age. In both cases the great shortening of the neck is dominating and conspicuous. The head is inclined slightly forwards and rotated somewhat to the right. The movements of the cervical vertebral column are highly restricted. X-ray examination of the first case shows that the cervical and the upper part of the dorsal vertebral column are fused into one continuous piece of bone; in the second case there is marked hypoplasia of the cervical vertebral column and apparently a partial osseous connection between two or three of the lower cervical vertebrae. In both cases spina bifida is present, in the first case involving C. VI-Th. I, in the second case merely indicated, involving Th. II-III. The left scapula is elevated and in the first case slightly fixed; in the second case it is firmly adherent, with impaired abduction of the arm. This fixation was mobilized through Kölliker's operation.

The pathological anatomy is briefly dealt with in connection with Sprengel's deformity. The author points out that Klippel-Feil is no distinctly defined deformity from a pathological anatomical point of view, and he also maintains that Klippel-Feil's syndrome is the most pronounced manifestation of the inhibition deformity, which is the basis of Sprengel's deformity.

Klippel-Feil's syndrome may indicate operation in cases where the elevated scapula is fixed, with a consequently impaired abduction of the arm. A survey is given of the operations practiced in cases of elevated scapula. The author holds that even if it is possible to improve the patient's appearance by lowering the scapula, great caution should be exercised; especially in these cases a forced lowering of the scapula may be dangerous, as a damage to the plexus brachialis seems to be easily provoked. Operations should only be undertaken in case of functional impairment and in such cases Kölliker's operation is recommended.—*H. Nilsonne, M.D., Stockholm, Sweden.*

On Pathological Changes of the Intervertebral Discs. Sune Norlén. *Hygiea.* LXXXIX, Part 4.

The author of this work was occupied with reading the proofs, when in a few days an acute infectious disease terminated his life. He had drawn up the outlines of a comprehensive work on the intervertebral discs with reference to the pathology of the mesenchyma.

The material of this investigation comprises 309 cases from eighteen to eighty-nine years of age. The regressive changes of the intervertebral discs have been examined macroscopically and microscopically. The earliest and most extensive changes are seen in the lower part of the vertebral column. Generally the disc between the fourth and fifth lumbar vertebra is first changed. The regressive changes are considered chiefly as an evidence of age. Arteriosclerosis and degeneration of the discs do not develop simultaneously, the former advancing more rapidly and being a more constant phenomenon in advanced age than the latter. The senile osteoporosis and the degeneration of the discs do not seem to appear simultaneously, and neither do they develop to equal degree. It rather appears as if the degree of one of these changes were in inverse proportion to the degree of the other change.—*H. Nilsonne, M.D., Stockholm, Sweden.*

Compression Fractures of the Spine. Diagnosis and Treatment. Robert B. Osgood. *J. Am. Med. Assn.*, LXXXIX, 1563, Nov. 5, 1927.

Compression fractures comprise about one-half of all spine fractures. There may be associated fracture in other parts of the vertebra, including the spinous process and transverse processes, but they are relatively unimportant. Fractures complicated by cord lesions are not included in this paper. The crushing fracture in the body of the vertebra, with local symptoms only, is quite common, often diagnosed erroneously and given poor treatment. The basis for this conclusion is an analysis of 248 fractures from the Boston City Hospital, Massachusetts General Hospital, and from the author's private patients, along with a review of the literature.

The mechanism of the lesion is sudden sharp flexion of the spine, usually from serious accidents, but may result from what appears to be a light sprain. In all flexion injuries of the spine, a fracture should be suspected, and if pain is referred to the back with localized tenderness and muscle spasm, a careful roentgenological study of the entire spine should be made, including in every instance the lateral view. The compression is to be found at the anterior part of the body and will frequently be missed in an anterior-posterior position.

Treatment: Mild or severe compression fractures of a single vertebra without cord symptoms. In the sacrum they heal quickly with good function, and very little treatment is indicated. In the typical early case, with more or less crushing of the body, full function may be expected after four to six months, if treated in recumbency on a plaster shell, or other means of securing hyperextension during the first three months.

The patient is gradually returned to upright position, with the back supported and physical therapy instituted. Operation is not indicated except in those cases of severe fracture with an irreducible kyphos in a man who follows a strenuous occupation. In such patients, the artificial fusion is an extra safeguard against future weakness.—*W. B. Carrell, M.D., Dallas, Texas*

Fractures About the Elbow. Nathaniel Allison. *J. Am. Med. Assn.*, LXXXIX, 1568, Nov. 5, 1927.

The author presents in a comprehensive way, the elementary details of the mechanics and care of the fractures about the elbow. Many disasters in treatment of these conditions may be rightfully charged to incomplete knowledge of the injury and failure in following out the principles which are well known to those interested in fractures.

Reduction should not be attempted until a careful study has been made of the roentgenograms, the deformity present, the circulatory condition and the evidence of nerve injury. Volkman's contracture, due to interference with venous circulation, may result from hemorrhage or pressure from the fragments, but far more frequently is due to tight splints or bandaging.

Acute flexion of the elbow, in a badly swollen arm, further embarasses the circulation and should not be done until the swelling subsides. An anaesthetic is necessary for relaxation and most fractures at the lower end of the humerus may thus be reduced by traction and carrying the elbow forward. The forearm is fixed in the acutely flexed position, preferably by the Lund swathe. The advantage of this dressing is fixation without the danger of constriction.

Severe fractures involving the joint, and compound injuries frequently require open surgical reduction; olecranon fractures do best after open fixation. Motion should be started early but stiffness in the joint, a common sequence in fractures, must not be forcibly treated by the daily pump-handle method, because it only increases the irritation and may lead to an ossifying myositis, which is not uncommon about the elbow. In the absence of bone block, the child should be left to gradually increase the motion, in play or gymnasium work with voluntary work.—*W. B. Carrell, M.D., Dallas, Texas*

Treatment of Fractures of the Os Calcis by Arthrodesis of the Subastragalar Joint. A Report of Twenty-six Cases. Philip D. Wilson. *J. Am. Med. Assn.*, LXXXIX, 1676, Nov. 12, 1927.

Fractures in the os calcis are severe disabilities, and the prognosis for good recovery is poor. They are usually fissured, or comminuted, and involve the calcaneo-astragalar joint. The body of the os calcis spreads outward and forward, leaving the foot in pronation, and with uneven fragments on the articular surface.

On healing, this rough articular area produces arthritic changes and limited motion with an unsatisfactory function in the foot. The methods in use, manipulation, moulding, and lengthening the tendo Achillis, have not yielded desirable results.

The operation of astragalar arthrodesis, including the cuboid and scaphoid joint in a few cases, resulted in bony ankylosis in the operated joints, and good results with only a slight difference in general mobility in the foot, as compared to the limited motion following the more conservative treatment.

The best results were in early operations, two or four weeks after the injury, when the average postoperative disability was five and one-half months. Late operations gave eight months disability. The operation is not advised for all fractures, but should be done when the comminution involves the joint surface.—*W. B. Carrell, M.D., Dallas, Texas*

FRACTURES OF THE LOWER EXTREMITY OF THE RADIUS. DIAGNOSIS AND TREATMENT. William Darrach. *J. Am. Med. Assn.*, LXXXIX, 1683, Nov. 12, 1927.

Diagnosis is suspected when there is an injury to the wrist and localized tenderness over the bone. Localized hemorrhage is suggestive, if observed before being masked by subsequent oedema. Even when deformity makes the presence of fracture unmistakable, roentgen-ray studies should be made before attempting reduction.

The lower fragment can be shifted, or tilted, in four directions, and may be rotated. There may be a combination of these positions. The relation of the ulnar and radial styloids should be compared with the normal wrist. Reduction should be accomplished with the least degree of trauma. The patient is relaxed with anaesthetic, and the impaction or deformity corrected by traction and manipulation. Fixation splints do not include the metacarpal-phalangeal joints. Motion is started early. Improper reduction may cause serious impairment of wrist function. The common deformity of radical deviation of the hand, and a prominent ulnar styloid indicates an unreduced impaction.

A persistence of the angulation, or silver fork deformity, means that the backward shifting or tilting of the lower fragment persists. Limitation or weakness in finger flexion, results from backward shifting to such an extent that the sharp edge of the proximal fragment impinges on the flexor tendons.

Pronation and supination difficulties come from the persistence of tilting and derangement of the inferior radio-ulnar articulation. A subperiostal resection of the neck of the ulna, leaving the styloid intact, may have to be done for disability in late cases. Other operative procedures are indicated in some old unreduced fractures, but by gently and thoroughly handling the early injuries, uniformly good results may be expected.—*W. B. Carrell, M.D., Dallas, Texas*

THE INFLUENCE OF WAR SURGERY ON TREATMENT OF FRACTURES IN GREAT BRITAIN. W. Rowley Bristow, F.R.C.S., London. *J. Am. Med. Assn.*, LXXXIX, 1920, Dec. 3, 1927.

Fracture treatment in England prior to the War was given little attention in actual practice, and in teaching institutions. Results necessarily were not good. The lessons of the War,—First: The value of the Thomas splint. Second: The need of segregation, and Third: The value of team work.

These principles so well demonstrated during the War, can be applied with equal force to postwar civil practice. Skilled surgeons may operate under ideal conditions with little risk, but unfortunately the great bulk of fractures are not treated by these surgeons, but are handled in the smaller hospitals by men with less training. These men can be taught the principles of non-operative fracture treatment and can apply the Thomas splint, or other simple apparatus efficiently, but they cannot be expected to have the training or equipment necessary for good operative treatment.

The value of segregation should not be underestimated. In the teaching hospitals of England, from tradition, the encroachment of specialization is viewed with alarm. The fear is that men will be trained as specialists instead of good doctors. The argument

is fallacious, for a man will be better trained by receiving instruction in a particular field from surgeons who are constantly working with segregated patients in that department. He will see more patients, and have better facilities for treating them.

The argument for better service for the patient cannot be refuted. The group of surgeons interested in fractures, with all cases segregated in the hospital where portable x-ray, traction and other apparatus are installed, and with physiotherapy and work shop available, there can be no doubt, they will render the patient a greater service than when patients are scattered through the hospital and treated usually by the junior officers. These chiefly are lessons of the War.—*W. B. Carrell, M.D., Dallas, Texas*

TRACTION AND SUSPENSION. Joseph A. Blake, M.D., *J. Am. Med. Assn.*, LXXXIX, 1924, Dec. 3, 1927.

All fractures cannot be treated by traction and suspension. When applicable, good results only will obtain, when care is exercised in the minute details of applying and maintaining adequate traction. Early traction in sufficient amount will reduce many fractures in long bones in a few hours, without an anaesthetic, and the treatment is maintained, with the limb free for dressings, massage and motion.

The author describes the methods of applying traction for various fractures with careful detail and without the aid of illustrations.—*W. B. Carrell, M.D., Dallas, Texas*

FRACTURE OF THE SHAFT OF THE FEMUR. Kellogg Speed, M. D., *J. Am. Med. Assn.*, LXXXIX, 1926, Dec. 3, 1927.

When a diagnosis is made, the fractured leg should be splinted in extension before moving the patient. Permanent treatment starts on arrival at the hospital. Shock and complication are given first attention.

Non-operative treatment: Manipulation under an anaesthetic, on the fracture table, is suitable for many transverse fractures. Retention by plaster-of-Paris or continuous traction. Splinting some fractures may not require an anaesthetic. Skeletal traction is most efficient and the Steinmann pin generally more satisfactory than ice tongs. Follow up with x-ray and physiotherapy. Operative treatment is indicated when there is interposition of soft tissue and when reduction and traction methods fail. Careful handling and the simplest methods of fixation are best. If operation is advisable, do not delay.—*W. B. Carrell, M.D., Dallas, Texas*

THE DIAGNOSIS AND TREATMENT OF FOUR HUNDRED AND FIFTY PAINFUL SHOULDERS. Jennings M. King, Jr., and George W. Holmes. *J. Am. Med. Assn.*, LXXXIX, 1956, Dec. 3, 1927.

The findings in this series of shoulder injuries are of especial interest because of the small percentage having disabilities from conditions which are generally believed to be quite common in painful shoulders. One and three-tenths per cent. had periarthritis, two and eight-tenths per cent. had subacromial bursitis. X-ray findings were negative in 300, or sixty-seven per cent. of the cases.

Attention is called to the diagnostic signs and the frequency of subcorocoid bursitis, and to the relaxed shoulder with subsequent pathologic changes resulting from non-use, induced by referred pain in spine and chest conditions.

The proximity of the capsule and bursae to the muscle and ligament attachments about the shoulder permit frequent inflammatory reaction in the synovial tissue when these structures are injured.

Treatment in shoulder disabilities must be directed to the cause of the injury, and this removed when possible. The local treatment, fortunately, is the same for many of the conditions, and consists in placing the shoulder at rest in abduction, followed by suitable physiotherapy.

A notable exception is the fracture of the greater tuberosity which is produced by a shearing force, when the process is carried violently under the acromion. The fragment is held firmly in place by the supraspinati when the arm is held in adduction.—*W. B. Carrell, M.D., Dallas, Texas*

TUBERCULOSIS OF THE HIP. END RESULTS OF ONE HUNDRED AND FIFTY CASES. Alan DeForest Smith and Win H. Watters. *J. Am. Med. Assn.*, XC, 189, Jan. 21 1928.

From 1904 to 1921, 208 patients were treated at the Country Branch of the New York Orthopaedic Hospital. This institution at White Plains has an environment suitable for tuberculous patients, and the treatment followed was fixation in a Taylor traction splint and heliotherapy.

Diagnosis during these years, made from clinical study and x-ray findings: Forty-six cases were excluded from the report because the evidence was not sufficient to make a positive diagnosis of their ever having the disease. In the final study of one hundred and fifty cases it was found that twenty-four per cent. died, one-half of these from tuberculous diseases, one-fourth from other causes, and one-fourth not known. The remaining one hundred and fourteen living patients were treated an average of seven and three-tenths years, and on last report forty-seven per cent. were active and twenty-seven per cent. quiescent. Two patients were free from symptoms, and had a useful range of motion.

It was noted that quiescense occured in a higher percentage from a five-year group study than was present in the group under observation for ten years, thus emphasizing the disposition to relapse after several years. With few exceptions, the patients looked well, and did not have the appearance of sick children even when there was progressive destruction in the hip. Nine patients in the group have subsequently had a fusion operation done and some are now solidly fused, but insufficient time has elapsed to make a final report.

Diagnosis of tuberculosis of the hip should not be made unless it is proven by guinea pig inoculation, or exploratory operation. Results cannot be estimated from a five-year study, nor with accuracy in the ten-year period. Conservative treatment of tuberculosis of the hip has not proved satisfactory.—*W. B. Carrell, M.D., Dallas, Texas*

CHRONIC EPIPHYSITIS AND METAPHYSITIS. A. Owen-Johnston, New Zealand. *Med. J. Australia*, Supplement No. 10, 298, Oct. 29, 1927.

A condition of the long bones is described, a subacute or chronic inflammatory disease, involving the metaphysis or epiphysis or both; non-tubercular, but often simulating tubercular disease, and caused by the staphylococcus pyogenes aureus. The lesions may be single or multiple, involve usually the upper or lower extremity of the tibia or femur, and with about equal frequency, and occur between the ages of three and fifteen, usually from ten to fourteen.

The infection comes from the blood stream and is deposited in the metaphysis, from which it may be carried into the center of the epiphysis by a small artery from the diaphysis. Injury probably plays a small part in localizing the infection.

Depending upon the virulence of the bacteria, the area may be at once shut off by a mild inflammatory reaction, with subsidence of activity but persistence of a latent infection which may later be activated by trauma. In case of a more virulent organism, there will be a small area of necrosis of the end of the diaphysis with an inflammatory zone limiting the spread, ending in a small abscess cavity in the diaphysis, whose contents finally work their way to the surface, the abscess subsequently healing.

The symptoms are soreness in the neighborhood of a joint, intermittently, brought on by an unusual exertion, always relieved by resting, with some swelling and tenderness; moderate elevation of temperature, and leucocytosis: and a small cavity showing in the

radiogram. There are no joint symptoms, but deep tenderness over the epiphyseal line. In differentiation from hip joint tuberculosis, with involvement of the epiphysis, the absence of family tuberculosis and of pulmonary tuberculosis, and the presence of leucocytosis with relative increase of polymorphonuclears, should make the diagnosis.

In the milder forms, the prognosis should be guarded because of a possible future lighting up of the latent infection. When the epiphysis is involved, with necrosis, an ankylosed joint usually follows.

When the metaphysis only is involved, the cavity should be opened and drained in a direction away from the joint. The author Dakinizes these wounds. With involvement of the joint, drainage and sequestrectomy have to be done and the prospect is for ankylosis. The author proposes in future cases of epiphyseal involvement, to attempt by early operation to drain the epiphysis from outside the capsule.

The absence of any long, absolutely quiescent periods and of a sharply circumscribed abscess cavity, differentiate these cases from Brodie's abscess.

Detailed histories of six cases are given.—*Edward N. Reed, M.D., Santa Monica, Calif.*

THE DYNAMICS OF THE FUNCTIONS OF THE HAND, WITH CONSIDERATIONS AS TO METHODS OF OBTAINING THE POSITION OF FUNCTION BY SPLINTS. Allen B. Kanavel. *Med. J. Australia*, II, 598, Oct. 29, 1927.

The anatomy and motor mechanism of the hand are thoroughly described, in relation to function. The sequelae of injuries and infections of the hand are enumerated. The author then outlines the use of "tension splints", which he considers of equal importance with physiotherapy.

The materials used in making these splints are discussed, and the principles of their construction and use. The author constructs his own splints.

This article is full of detail and very explicit as to construction and use of tensi splints, but does not lend itself well to abstracting.—*Edward N. Reed, M.D., Santa Monica, Calif.*

SACRALIZATION OF THE FIFTH LUMBAR TRANSVERSE PROCESS AND ITS RELATION TO LOW BACK PAIN. K. S. Macky, Auckland. *Med. J. Australia*, Supplement No. 10, 303, Oct. 29, 1927.

With the condition named in the caption is considered also its counterpart, the lumbarization of the first sacral segment. This region of the spine is particularly prone to congenital anomalies, some observers estimating their frequency of occurrence at as much as thirty-one per cent. In conjunction with these abnormalities, spina bifida occulta frequently occurs. The condition may be unilateral or bilateral and when bilateral may be much more pronounced on one side.

Symptoms do not appear, as a rule, before the third decade of life, when the body is becoming "set", and their advent is precipitated by faulty posture or by trauma.

Symptoms may occur without impingement of the process against the ilium, and are probably due to misalignment of the sacrolumbar joint, with consequent strain on the ligaments and irritation or pressure on the emerging nerves. There is a history of a long continued pain which is constant but not severe. The more complete types give an arthritic syndrome,—local pain, limitation of movement, and deviation away from the affected side.

The less complete types gives a neuritic syndrome, local pain, referred pain, and sensory changes. In bilateral cases, symptoms are usually referred only to the side of less complete sacralization, the completely sacralized side being the more stable.

In the arthritic group the pain and tenderness are localized at the iliolumbar angle. In the neuritic group there is a low back pain and pain in the back of the thigh and outer side of the leg. The pain is aggravated by jarring movement. The fifth lumbar nerve

root is the largest in the body, but has the smallest foramen of exit, hence pressure from any encroachment is easy.

The condition must be differentiated from sacro-iliac and sacrolumbar strain and disease, from spondylolisthesis, osteoarthritis, post-fracture disability, static backache, genito-urinary, and pelvic disorders. The chief diagnostic factor is the radiogram.

The author feels that the treatment is essentially operative; but that conservative treatment with rest on Bradford frame with a lumbar support, followed by a belt and physiotherapy, should first be tried. He reports five cases which were operated on, all with complete cure. He describes an approach by splitting the erector spinae muscle; and a second by subperiosteal removal of the portion of the ilium overlying the transverse process.

The discussor of the paper felt that the condition is commonly present, and usually amenable to conservative treatment, with operation only for the more intractable.—*Edward N. Reed, M.D., Santa Monica, Calif.*

EPIPHYSEOLYSIS. M. A. Bernstein and R. A. Arens. *Radiology*, IX, 497, Dec. 1927.

The condition is known as "epiphyseolysis", "slipping epiphysis", "acute epiphysitis", and "epiphyseal coxa vara".

There is a softening and separation of the epiphyseal cartilage, causing the femoral head to separate from the neck. With reduction and immobilization, the head reattaches. Symptomatically there is pain, muscle spasm, and rigidity, external rotation and adduction of the thigh; and moderate coxa vara may result. The affection may be unilateral or bilateral.

As to etiology, the general belief seems to be in a predisposition, constitutional or the result of endocrine disturbance, with trauma as a possible determining factor in cases.

The importance of trauma as a causative factor is minimized by the fact that most children have repeated slight injuries to their extremities, and that even so severe an injury as closed reduction of a congenital dislocation has seldom if ever caused a separation of the head. The condition occurs usually during adolescence.

With the softening and absorption of the epiphyseal cartilage, the head is sheared off by the superincumbent body-weight, remaining in the acetabulum, while the neck is displaced upward and rotated outward, the head rotating downward and backward.

Radiologically, the cementing element between head and neck seems to have melted away and the neck appears to have been pulled upward and wedged into the upper half of the head, which appears cup-like. The neck appears long and rounded off at the epiphyseal margin. The broadening and flattening of the neck and head seen in Legg-Perthes disease are absent in epiphysiolysis. In their late stages these two diseases are difficult to differentiate.

The early diagnosis is very difficult, but after the separation of the head, is easy. Acute pain in the hip joint, or more usually in the knee, with progressively developing disability, should suggest the possibility of this condition. It is to be differentiated from: (1) Acute septic epiphysitis, which gives septic symptoms, local inflammatory findings, and an abducted and externally rotated extremity, and erosion of the articular surface in the roentgenogram; (2) Tuberculosis, which gives internal rotation, while epiphysiolysis gives external rotation of the thigh. In tuberculosis there is muscle spasm, and persistent pain after immobilization; (3) Fracture, ruled out by the history and x-ray; (4) Legg-Perthe's disease, occurring usually in children under ten years, while epiphysiolysis occurs in young adults. The x-ray differences are characteristic in well developed cases. The authors believe that vertebral epiphysitis, infraction of the metatarsal head, and Schlatter-Osgood disease belong to the same group and probably have the same etiological factors.

Detailed reports of six cases are given and there are good illustrations.—*Edward N. Reed, M.D., Santa Monica, Calif.*

OPERATION FOR TIBIOTARSAL TUBERCULOSIS IN CHILDREN; LATE RESULTS. F. Pouzet. *Revue d'orthop.*, XIV, 377, Sept. 1927.

This paper is a study of thirty-nine cases in which operation was done for tubercular ankle joints in children. Of these, twenty-five were done after prolonged conservative treatment and fourteen in early stages of the disease. The indications for operation in the late cases were chiefly increase in symptoms and extension of the pathologic process. For the early cases, unusual severity was considered sufficient indication.

The technique consists in approaching the joint by way of an external incision, inward luxation of the foot and removal of the astragalus. This gives a clear view of the malleolar mortise and of the articular surface of the tibia. The wound is provided with wide drainage and a cast is applied. The cast is left on a month; two months, if there is much suppuration.

The astragalus was found to be involved in all the thirty-nine cases, the tibia in twenty, calcaneum in twenty-five, scaphoid in two, and cuboid in two. The average time for cure was eleven months after astragalectomy and thirteen months after tarsectomy. Children under six are cured more quickly than older ones. In this series, there were seventy-three per cent. cures, four per cent. not cured, twenty-three per cent. mortality. The high mortality is explained by the fact that the cases selected for operation were of the more severe type.

The late results have proved fairly good. After simple astragalectomy, eleven of which were done, eight cases have good functional feet. In one case, operated when two years old, the astragalus seems to have regenerated. Of seventeen cases traced after tarsectomy, one had a very good functional result, six good, seven rather good, two unsatisfactory, and one bad. The poor results seemed to be due to improper point of support for the tibia on the foot. If the tibia sits down on the anterior part of the calcaneum and against the scaphoid, the result is uniformly good. The function is poorer, the farther back the tibia rests over the calcaneum.

Astragalectomy is a mutilating operation and one cannot hope for so good a function after such a procedure, as after conservative immobilization in the more benign cases of tubercular ankles. As compared with resection of the knee, for example, the time required for cure after surgical intervention at the ankle is long, due probably to the irregular cavities for drainage.

In conclusion, the authors believe that there is no appreciable advantage to be gained by operation in these cases.—*W. A. Clark, M.D., Pasadena, Calif.*

CONTUSION AND SPRAINS. Isidore Cohn. *South. Med. J.*, XXI, 97, Feb. 1928.

He warns against making a diagnosis of sprains or contusions without careful investigation, and ruling out all possibility of fractures. Numerous cases are reported and x-rays shown where diagnosis of a minor injury was made, but the x-ray showed a fracture. A thorough knowledge of the epiphyses of bones is necessary in order to avoid the error of mistaking a normal epiphysis for a fracture. Fractures of the skull and spine are often overlooked. Sprain fractures and injuries to joints are often overlooked until persistence of symptoms causes a thorough investigation. Damage suits are not infrequent due to overlooking a fracture. This is a very good article, well illustrated, and should be of great value to the general practitioner and surgeons who first see these cases.—*F. G. Hodgson, M.D., Atlanta, Ga.*

NERVE INJURIES COMPLICATING FRACTURES. R. Wallace Billington. *South. Med. J.*, XXI, 91, Feb. 1928.

The types of injuries to nerves in connection with fractures are discussed. Also the diagnosis, treatment and prognosis are considered. In cases in which operations upon the nerve itself are not advisable or successful other methods may be used. He presents a case with good pictures illustrating an excellent result obtained by tendon transplanta-

tion on a patient who had previously had a suture of the musculospiral without benefit. His technique, which is a modification of the Jones-McMurray operation, is described and illustrated.—*F. G. Hodgson, M.D., Atlanta, Ga.*

SURGICAL PROCEDURE IN OBLITERATIVE VASCULAR DISEASE (THROMBO-ANGIITIS OBLITERANS). E. V. Allen and H. W. Meyerding. *Surg. Gynec. Obstet.*, XLVI, 260, Feb. 1928.

This article is a study of forty-five cases. Operations performed were (1) incisions of toes or removal of toe nails, (2) amputation of toes, (3) amputation below knee, (4) amputation above knee. In group (1) there were fifteen cases, only one of which was successful. In group (2) there were six cases with four successes. In group (3) there were twenty-one amputations below knee with seventy-one per cent. healing by primary union and ten per cent. healing, though delayed, leaving nineteen per cent. which failed to heal. In group (4) sixteen cases of amputation above the knee, healing was primary in fourteen cases and delayed in two. Not all of these operations were done in the Mayo Clinic. Cases treated surgically should also be treated medically to increase blood supply and aid healing. Radiant heat, intravenous injections of foreign protein or radium chlorid are used to increase circulation and relieve pain. Incisions of toes and removal of nails should not be attempted in these patients, but amputation of toes is permissible in selected cases, amputation below the knee is to be tried in most cases. The above results are not obtainable in older patients with gangrene due to arteriosclerosis.—*R. W. Billington, M.D., Nashville, Tenn.*

STABILIZATION OF THE SHOULDER JOINT FOR HABITUAL DISLOCATION. Hans Spitzy. *Surg. Gynec. Obstet.*, XLVI, 256, Feb. 1928.

Cases operated upon by the author's method recovered complete working capacity and full motion, with no recurrences. The operation consists of exposing the deltoid insertion by a curved incision, detaching same and retracting the muscle upward, then passing strong, double silk around the surgical neck of humerus and tying in front and suturing and tying the four strands to the coracoid process and its attached biceps tendon. The capsule on the front of the shoulder joint is reefed and sutured over these four strands of silk, thus reenforcing and shortening the capsule at its weak part. The deltoid insertion is sutured in place and the arm is kept at rest for four weeks; then careful exercises are begun.—*R. W. Billington, M.D., Nashville, Tenn.*

OPERATIVE CORRECTION OF CLAW-FOOT. Hans Spitzy. *Surg. Gynec. Obstet.*, XLV, 813, Dec. 1927.

The most severe cases are congenital. The cause is usually myelodysplasia, a derangement of development of the lower segments of the spinal cord, often associated with spina bifida. Other causes are syringomyelia, multiple sclerosis and other types of paralysis of peripheral nerves. The author's operation consists of his "slipper incision" around the heel and posterior half of the foot, reflecting all the soft tissues downward and then forward from the heel and under surface of foot, including the ligaments under the mid-tarsal region, thus permitting the pes cavus to be corrected completely. If after this there remains marked claw deformity of the toes, he transplants the extensor tendons of toes into the heads of the metatarsals. It is claimed that this operation was devised independent of, if not prior to, the work of Steindler, and presumably, of Jones.—*R. W. Billington, M.D., Nashville, Tenn.*

SYNOVECTOMY OF THE KNEE JOINT. C. H. Heyman. *Surg. Gynec. Obstet.*, XLVI, 127, Jan. 1928.

Cases should be carefully selected for this operation. The rationale is either the removal of the focus of infection within the joint or the removal of the sources of mechanical irritation. Types indicating operation are chronic infectious arthritis, also other

chronic types where large synovial fringes or cartilaginous bodies aggravate the inflammation by forming obstacles to motion. The disease should be quiescent and localized in one or a few joints. The surgeon should be guarded in promising increased motion, as this is not always obtainable though relief from pain and instability may give a satisfactory result. The operation is performed under a tourniquet through the patella splitting incision. Hemostasis should be complete before closure. Active motion in a hinged Thomas splint is begun after four days, avoiding too vigorous treatment or forced manipulations.—*R. W. Billington, M.D., Nashville, Tenn.*

THE STUMP AND THE PROSTHESIS. Helge Camitz. *Svenska läkartidningen*, Part 14, 1927.

A survey for the guidance of non-specialists of the views on amputation and artificial limb problems, which are nowadays fairly generally acknowledged by specialists. From the contents the following may be mentioned.

Exarticulation in the Chopart joint as well as Pirogoff's amputation are rejected. Low amputation of the leg is preferred. Neither is Gritti's amputation considered fully satisfactory.

As regards amputations of the arm the author uses Sauerbruch's type of artificial limb and in the following cases operates according to Sauerbruch-Anschütz:

1. All bilateral amputations.
2. In cases of amputation of one arm, provided the patient is not a laborer, and that he himself insists upon this operation after having been informed of the existing advantages and disadvantages.—*H. Nilsonne, M.D., Stockholm, Sweden.*

OSTEOCHONDRITIS DEFORMANS JUVENILIS DORSI. S. Arnell. *Tidskrift i militär hälsovård*, Part 2, 1927.

The author refers to the works of Scheuermann, Buchman, and Robert Hansson on the subject. The author has collected material from the Military Hospital of Boden and arrived at the conclusion that these vertebral changes are one of the most usual causes for insufficiency of the back among the conscripts. He points out that individuals with these changes are not fit to serve as volunteers or in those branches of the service where the troops have to carry loads (knapsacks).—*H. Nilsonne, M.D., Stockholm, Sweden.*

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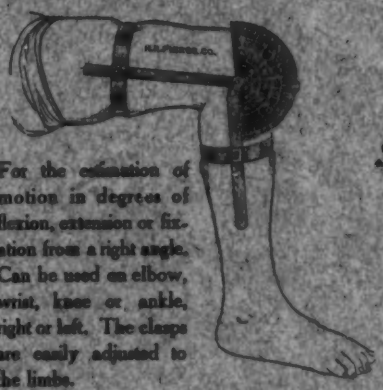

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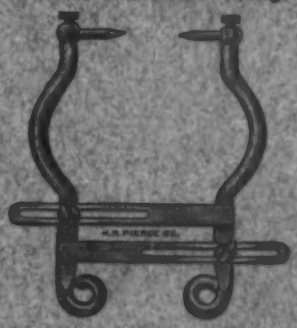

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Suggestions for Contributors

Manuscript offered for publication in *The Journal of Bone and Joint Surgery* should be sent to the Editor, 166 Newbury Street, Boston, Mass. All articles are acknowledged as soon as received, and a reply sent as to the disposition of the articles as soon as possible after that date. Original articles are accepted only with the understanding that they are contributions exclusively to this Journal.

To aid in uniformity of presentation, it is requested that:—

All manuscripts be typewritten with double spacing and good margins.

The original be sent to the editor, the author keeping a carbon copy as the original is not returned.

Photographs and drawings intended for illustrations be numbered, the top plainly indicated, and the author's name written on the back of each illustration. When x-rays are used, black and white prints should be furnished rather than negatives.

All lettering on prints and all drawings and charts be made in black India ink.

Legends be furnished in separate lists numbered to correspond with the illustrations.

Bibliographies, if included, be prepared in one list at the end of the article, each reference to an article in a periodical to be given as follows:

Jones, J. A.: Treatment of Club-foot. Surg. Gynec. and Obstet., LXXIII, 56, 1926.

Reference to a book should be in the following form:

Jones, J. A.: Textbook of Orthopedic Surgery. Ed. 3, Philadelphia, Brown & Graham Co., 1927.

Accuracy in the preparation of bibliographies will save much time and correspondence.